COORDINATION-FOCUSED PATENT POLICY

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This Article explores the practical consequences of an important shift that has recently taken place in patent theory. Although it was long agreed that the purpose of granting patents is to reward invention, today many scholars instead attempt to justify the patent system based on its role in facilitating information exchange and enabling technical coordination among firms. This change in justification is controversial, and its viability remains a fiercely contested question. But despite intense attention at the level of theory, little has been said about the consequences of this debate for patent policy itself. This Article seeks to fill that void, developing a set of mid-level principles from coordination theory and showing how these principles imply different outcomes for a wide range of important patent policy questions.

This analysis has a number of surprising consequences. Since its inception, the goal of facilitating coordination has been closely associated with a policy of granting broad patent rights at an early stage in the technology lifecycle. But this conventional view overlooks important differences in the kind of breadth and the nature of the timing that determine the success of the coordination function. As a result, and contrary to long-held assumption, a coordination-focused system wouldn't necessarily require broader patent rights or earlier grants—in fact, it might allow just the opposite. Moreover, there are many constraints in the current rewards-focused system that prior scholars have taken for granted, but that could be substantially relaxed under a coordination-focused regime.

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INTRODUCTION

For its first two centuries, the U.S. patent system had a mission that was clear and well-understood. Courts and commentators long agreed that the purpose of offering patent protection was to reward invention.[1] According to this view, the patent system addresses a public goods problem, using grants to subsidize an activity that would otherwise occur below the socially optimal level. In this way, the patent system is designed to effect a kind of decentralized tax-and-spend policy, with consumers bearing higher prices so that inventors may be compensated for inventive contributions they would not otherwise have incentives to make.[2]

In recent years, this consensus has broken. Scholars have since observed a variety of purposes the patent system may serve beyond simply rewarding inventive accomplishment. For example, commentators have suggested that patents may play an important role in reducing transaction costs around information, allowing for more open communication, mitigating the need for trade secret protection, and facilitating technology transfer.[3] Expanding this theory slightly, they have also noted that patents can be used to encourage public disclosure, reduce the costs of identifying potential collaborators, and enable smoother intra- and inter-firm cooperation.[4] Picking up on this theme of collaboration, another group has investigated the role that patents may play in the formation, operation,

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[1] *See* Ward S. Bowman Jr., Patent and Antitrust Law: A Legal and Economic Appraisal 2-3 (1973); *see also* F.M. Scherer & David Ross, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE 621-24 (3d ed. 1990) (giving standard rewards-based explanation as the logic of patent protection); Louis Kaplow, *The Patent-Antitrust Intersection: A Reappraisal*, 97 HARV. L. REV. 1813, 1817, 1821-22 (1984).

[2] *See* Anup Malani & Jonathan Masur, *Raising the Stakes in Patent Cases*, 101 GEO. L.J. 637, 638 (2013).

[3] *See* Edmund W. Kitch, *The Nature and Function of The Patent System*, 20 J.L. & ECON. 265, 277-79 (1977) [hereinafter Kitch, *Nature and Function*]; William M. Landes & Richard A. Posner, The Economic Structure of Intellectual Property Law 328 (2003); Paul J. Heald, *A Transaction Costs Theory of Patent Law*, 66 OHIO ST. L. J. 473, 488-89, 497 (2005) [hereinafter Heald, *Transaction Costs*]; Paul J. Heald, *Transaction Costs and Patent Reform*, 23 SANTA CLARA COMPUTER & HIGH TECH. LJ 447, 457 (2006); Julien Pénin, *Patents Versus Ex Post Rewards: A New Look*, 34 RESEARCH POLICY 641, 649 (2005) [hereinafter Pénin, *Patents Versus Ex Post Rewards*] (discussing role of patents in technology transfer).

[4] *See* Landes & Posner, *supra* note 3, at 329; Robert Mazzoleni and Richard R. Nelson, *Economic Theories About the Benefits and Costs of Patents*, 32 J. ECON. ISSUES 1031, 1039 (1998); Robert P. Merges, *A Transactional View of Property Rights*, 20 BERKELEY TECH. L.J. 1477, 1487-90 (2005) [hereinafter Merges, *Transactional View*]; Robert P. Merges and Ashish Arora, *Specialized Supply Firms, Property Rights and Firm Boundaries*, 13 INDUSTRIAL & CORPORATE CHANGE 451 (2004); Heald, *Transaction Costs*, *supra* note 3, at 475 & nn. 15-16; Julien Pénin, *Patent Policy: A Need to Focus on Both Appropriation and Coordination Failure*, 16 EURO. J. OF ECONOMIC & SOCIAL SYSTEMS 109, 111 (2003) [hereinafter Pénin, *Patent Policy*].

and dissolution of joint ventures.[5] This emerging work suggests that a view of patents as merely rewards for invention may oversimplify their function in facilitating the development of new technology—that patents may also serve an important role in coordinating industry activity around technology after patenting has occurred.

This movement is controversial. Other commentators have questioned these coordination-related justifications for patent rights, suggesting that the patent system is ill-equipped to play these roles, is outmatched by superior approaches to these problems, or is otherwise best left to its traditional rewards-focused responsibilities.[6] But a purely rewards-focused view of the patent system has its challenges as well. For one, it is hard to explain why so many inventors participate in the patent system if rewards are their only objective, for only a vanishingly small number of patents ever return any kind of profit to their owners.[7] Moreover, many have argued that it is difficult to justify the current patent regime on the grounds of rewards alone.[8] As others have noted, there are a variety of non-patent alternatives that may be able to solve rewards problems as well as (or perhaps better than) the patent system.[9] Perhaps for these reasons, a growing group of commentators now invoke theories related to coordination when seeking to explain or justify our patent laws.[10]

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[5] *See* William E. Kovacic, *Intellectual Property Policy and Competition Policy*, 66 NYU ANN. SURV. AM. L. 421, 424 (2011); Antoine Bureth et al., *Patenting Practices Within the Upper-Rhine BiovalleyNetwork: Exclusion and Coordination Rationales*, 8-9 (2005) (unpublished manuscript), *available at* http://www.liuc.it/ricerca/istitutoeconomia/laweconomicsjuly2005/papers/Bureth_et_al_LIUCpaper.pdf.

[6] *See*, *e.g.*, Michael J. Burstein, *Exchanging Information Without Intellectual Property*, 91 TEX. L. REV. 227, 246-47, 262 (2012); Mark A. Lemley, *The Myth of the Sole Inventor*, 110 MICH. L. REV. 709, 748 (2012) [hereinafter Lemley, *Myth*]; Robin Feldman & Mark A. Lemley, *Does Patent Licensing Mean Innovation*, 101 IOWA L. REV. 137, 139 (2015).

[7] *See* Clarisa Long, *Patent Signals*, 69 U. CHI. L. REV. 625, 626-27 (2002); Pénin, *Patents Versus Ex Post Rewards*, *supra* note 3, at 642, 646-48; John R. Allison et al., *Valuable Patents*, 92 GEO. L.J. 435, 440-41 (2004); Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495, 1500-08 (2000) [hereinafter Lemley, *Rational Ignorance*]. For a summary of other attempts to answer this question, *see infra* note 55 and accompanying text.

[8] *See* Landes & Posner, *supra* note 3, at 326-27; Heald, *Transaction Costs*, *supra* note 3, at 474-75, 499-501; Robert W. Hahn, *The Economics of Patent Protection: Policy Implications from the Literature* 4, 17-22 (2003), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=467489; Pénin, *Patent Policy*, *supra* note 4, at 117-19 (summarizing objections to the traditional rewards account); Bureth, *supra* note 5, at 5-6 (summarizing prior empirical work); F. Scott Kieff, *Coordination, Property, and Intellectual Property*, 56 EMORY L.J. 327, 401-404 (2006) [hereinafter Kieff, *Coordination*].

[9] *See infra* nn. 36-40 and accompanying text.

[10] *See*, *e.g.*, Landes & Posner, *supra* note 3, at 328; Pénin, *Patent Policy*, *supra* note 4, at 110-11, 124-25; Mazzoleni & Nelson, *supra* note 4, at 1037-38; Kitch, *Nature and*

Despite extensive discussion about the legitimacy of these coordination roles for the patent system, very little has been said about the consequences of this debate for patent policy itself. The incongruity is often striking. For example, in *The Economic Structure of Intellectual Property Law*, William Landes and Richard Posner conclude that the strongest arguments for the patent system have nothing to do with the traditional story about rewarding invention, instead citing theories that fall soundly within the coordination function.[11] But just a few pages later they conclude that these justifications—while "compelling in the aggregate"—tell them nothing about what patent policy should actually look like.[12] And this admission is indicative of a much larger problem. Although increasing numbers of scholars have embraced an entirely different justification for the patent system than the one that has persisted for over two hundred years, no one has thoroughly examined the consequences of this shift in purported mission.[13] Instead, commentators have simply assumed that coordination-focused policy would look exactly the same as rewards-focused policy, or that, if there were any differences at all, coordination policy would require awarding earlier, broader patent grants.[14] As a result, the debate about the desirability of using the patent system in these unconventional ways has proceeded without a well-developed understanding of what such a system would actually require.[15]

Part of the reason the coordination function is not better understood is that commentators have not agreed on what the term actually means. Prior work in this area has been largely descriptive, and as such hasn't required a precise definition of which uses of the patent system are (and aren't) within the bounds of the coordination theory.[16] Without a stable definition, the coordination function

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Function, *supra* note 3, at 276; Heald, *Transaction Costs*, *supra* note 3*;* Merges, *Transactional View, supra* note 4, 1487-90; Oskar Liivak, *Maturing Patent Theory from Industrial Policy to Intellectual Property*, 86 TULSA L. REV. 1163, 1179 (2012) [hereinafter Liivak, *Maturing Patent Theory*]; Paul J. Heald, *Optimal Remedies for Patent Infringement: A Transactional Model*, 45 HOUS. L. REV. 1165, 1170 (2008) [hereinafter Heald, *Optimal Remedies*].

[11] *See* Landes & Posner, *supra* note 3, at 326-30. An extensive discussion of what this Article means by "coordination function" is included in Part II.

[12] *See* Landes & Posner, *supra* note 3, at 330-31.

[13] Indeed, the most extensive investigation of the policy implications of these theories seems to be found in the 1977 article that first postulated them. *See* Kitch, *Nature and Function*, *supra* note 3, at 280-89. More recently, Paul Heald has explored the consequences of a transactional focus for patent remedies. *See* Heald, *Optimal Remedies*, *supra* note 10, at 1172-74.

[14] *See* Burstein, *supra* note 6, at 245-46, 278 (making this observation); Dan L. Burk & Mark A. Lemley, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT 80-81 (2009) (same). This view can be traced to the early days of coordination theory, *see* Kitch, *Nature and Function*, *supra* note 3, at 280-89, but is long overdue for reevaluation. *See infra* IV.B & IV.C.

[15] *See* Landes & Posner, *supra* note 3, at 330-31; Pénin, *Patent Policy*, *supra* note 4, at 125 (both observing need for more development in this area).

[16] *See infra* notes 56–58 and accompanying text.

unsurprisingly lacks a unifying, fully developed theory, which has in turn made it very difficult to specify what coordination-focused patent policy would actually entail.

To these ends, this Article synthesizes a number of various theories proposed by commentators into a defined and unified theory for how patents can be used to facilitate coordination. In short, the coordination function includes any voluntary exchange of technical information made in reliance on the exclusive rights of patents—a definition that embraces many, but importantly not all, of the uses of patent system often associated with coordination.[17] It then develops this core theory into a set of mid-level principles, and shows how these principles implicate a large number of important policy questions.[18] The result is the first comprehensive analysis of how patent law would need to adapt if coordination goals were to be accepted as a primary purpose of the patent system.

A reasonable skeptic might ask whether any of this actually matters. After all, if *either* the rewards theory or the coordination theory leads to a system of "strong" patent rights, what really is the difference? But, as this Article will show, one's answer to the question of "why have a patent system?" has substantial and far-reaching consequences for a wide array of second-order questions. Upon reflection, this shouldn't come as a surprise: the rewards and coordination functions solve different problems. They have quite different theories of operation, which in turn lead to divergent intermediate principles of what the patent system should offer patent holders. For example, the rewards-versus-coordination debate turns out to have significant consequences for the ideal stability of patent grants, the reliability of the right to exclude, and the optimal breadth of patent protection. These mid-level values in turn implicate a wide range of policy levers, such as the amount of scrutiny given to patent applications,[19] the scope of patent claims,[20] the timing of patent grants,[21] the degree of deference paid to the patent office once a patent has issued,[22] and the antitrust analysis applied to mergers of competing patent portfolios,[23] just to name a few.

By exploring these policy implications, this Article makes several distinct contributions. First, this analysis reveals that, if the coordination function is recognized as a legitimate goal of the patent system, it will be necessary to reexamine many aspects of patent law that were previously settled based on explicitly rewards-focused reasoning. The divergence between rewards- and coordination-focused policies turns out to be extensive, and reaches to areas of the law that have not been previously associated with the rewards vs. coordination

[17] *See infra* II.
[18] *See infra* III & IV.
[19] *See infra* IV.A.
[20] *See infra* IV.B.
[21] *See infra* IV.C.
[22] *See infra* IV.A.
[23] *See infra* IV.B.

debate. Moreover, even in the areas where prior commentators have assumed divergence—such as the timing and scope of patent grants—the differences between coordination and rewards do not always follow the expected course.

Second, these policy implications fill a critical void in the ongoing debate about the desirability of using the patent system to facilitate coordination at all. Both the rewards function and the coordination function have substitutes outside the patent system—grants, prizes, and tax credits in the case of the rewards function,[24] more vigorous enforcement of contractual restraints and trade secrets in the case of the coordination function.[25] Prior analysis of the desirability of using patents to facilitate coordination appears to have been hamstrung by a lack of understanding of what this initiative would actually entail. By shedding light on the relationship between coordination objectives and the specifics of implementation, this Article contributes to the greater debate about the advantages and disadvantages of addressing these goals with the patent system as compared to its non-patent alternatives.

Third, this examination of the coordination function yields insights that remain salient even if coordination is ultimately rejected as a primary goal of the patent system. In the event the rewards function retains its seat as the dominant reason for having a patent system, the coordination function may nonetheless serve as an important second-order consideration. As this Article will show, one virtue of coordination theory is that it often provides guidance in situations where the rewards theory proves ambiguous. Thus a deeper understanding of the coordination function may actually assist rewards-focused policymaking as well, providing clearer guidance and marginal benefits without sacrificing the primacy of rewards goals.

This Article proceeds in five parts. Part I introduces the rewards function of the patent system and the traditional approaches to patent policy that have followed therefrom. Part II discusses several coordination-related understandings of the patent system and defines the coordination function for purposes of this Article. Part III develops a theory of patent-based coordination and identifies several features of that patent system that will have a significant influence on the coordination function's effectiveness. Part IV applies the results of Part III to a variety of issues in patent law and explains how these questions would need to be evaluated differently for a patent system increasingly focused on coordination as opposed to rewards. Part V concludes.

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[24] *See* Daniel J. Hemel & Lisa Larrimore Ouellette, *Beyond the Patents-Prizes Debate*, 92 TEX. L. REV. 303, 307, 311-12 (2013); Joseph E. Stiglitz, *Economic Foundations of Intellectual Property Rights*, 57 DUKE L.J. 1693, 1719-24 (2008).

[25] *See* Heald, *Transaction Costs*, *supra* note 3, at 476; Mark A. Lemley, *The Surprising Virtues of Treating Trade Secrets as IP Rights*, 61 STAN. L. REV. 311, 336-37 (2008) [hereinafter Lemley, *Surprising Virtues*].

I. THE TRADITIONAL JUSTIFICATION: REWARDING INVENTION

A. Theoretical Foundations

Under the traditional rewards theory, the purpose of the patent system is to incentivize invention through the promise of a regulatory bequest of market power.[26] In exchange for producing some socially useful invention, the inventor is given a time-limited exclusive right to her creation. In principle, that exclusive right vests its holder (at least sometimes) with some market power, which in turn causes some transfer of wealth back to the inventor. At the same time, the exercise of this market power results in some deadweight loss, which is to be accepted—or not—as the cost of rewarding inventive activity through a system of private exclusive rights.[27]

In this view, by offering an incentive to invent, the patent system addresses a classic problem of a public good. Without some form of regulatory intervention, the inventor would bear the full costs of creating the invention but would not be able to appropriate the full benefits, therefore leading to the under-production of inventions generally.[28] The goal of the rewards function is to correct this potential market failure by enabling inventors to appropriate more of the benefits of their new technologies.[29]

Traditionally, the rewards theory of the patent system was focused on incentivizing the earliest stages of invention.[30] Commentators have since expanded this basic view about what patents can be used to reward, noting that patents may also incentivize investment in technologies *after* their initial invention. Many technologies require significant investment to go from proof of concept to being widely available on the market.[31] As with the initial inventive steps, an inventor may hesitate to invest in the later stages of this process given the ease with which her competitors could appropriate the benefits of that investment.[32] Under this "commercialization incentives" variant of the rewards theory, in addition to any

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[26] *See* Hahn, *supra* note 8, at 7-8 (summarizing this argument). Mazzoleni and Nelson refer to this theory as the "innovation motivation" theory. *See* Mazzoleni & Nelson, *supra* note 4, at 1033, 1035.

[27] *See* Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in THE RATE AND DIRECTION OF INVENTIVE ACTIVITY 609, 619 (1962); Pénin, *Patent Policy*, *supra* note 4, at 113.

[28] *See* Landes & Posner, *supra* note 3, at 294; Kitch, *Nature and Function, supra* note 3, at 266; Pénin, *Patents Versus Ex Post Rewards, supra* note 3, at 643; Pénin, *Patent Policy*, *supra* note 4, at 111-12; Hahn, *supra* note 8, at 7-8.

[29] *See* Bowman, *supra* note 1, at 2-3; Pénin, *Patents Versus Ex Post Rewards*, *supra* note 3, at 643; Hahn, *supra* note 8, at 7-8.

[30] *See* Ted M. Sichelman, *Commercializing Patents*, 62 STAN. L. REV. 341, 357-59 (2010) [hereinafter Sichelman, *Commercializing Patents*].

[31] *See* Sichelman, *Commercializing Patents*, *supra* note 30 at 348-54.

[32] *See* Mazzoleni & Nelson, *supra* note 4, at 1040; Sichelman, *Commercializing Patents*, *supra* note 30 at 353-54, 372-74.

rewards a patent may provide to invent in the first place, a patent may also enable an inventor to capture more of the returns of investing in commercialization and other post-patenting refinements.[33]

Rewarding invention or commercialization with a system of exclusive rights has costs. First there is the administrative overheard of operating a patent system—the time and expense of filing patent applications, examining them, litigating patent disputes, and so on.[34] Then there are the costs imposed by the exclusives rights themselves: deadweight losses as a result of the inventor's market power, and a variety of potential dynamic harms.[35] For the rewards theory to justify having a patent system, the societal benefits of transferring wealth to innovators must exceed the administrative costs and deadweight losses incurred from doing so.[36]

As others have noted, there are a variety of policy alternatives that could serve provide similar incentives to inventors and commercializers: government grants, tax deductions, publicly and privately administered prizes, indirect subsidies for research, to name a few.[37] The traditionally recognized advantage of the patent system over these competitors is its administrative simplicity, since the value of exclusive patent rights is naturally dependent on the value of the underlying technology.[38] Rather than trying to place a dollar value on any given

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[33] *See* Kitch, *Nature and Function*, *supra* note 3, at 276; Michael Abramowicz, *The Danger of Underdeveloped Patent Prospects*, 92 CORNELL L. REV. 1065, 1067 (2007) [hereinafter Abramowicz, *Underdeveloped Prospects*]; F. Scott Kieff, *Property Rights and Property Rules for Commercializing Inventions*, 85 MINN. L. REV. 697, 707-10 (2001) [hereinafter Kieff, *Property Rights*]. As others have noted, the observation that patents may provide incentives to commercialize does not so much change the basic model of patents as rewards, but rather expands the scope of what kinds of activity they can be used to reward. *See* Rebecca Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1037 (1989); Burstein, *supra* note 6, at 241; *see also* Mazzoleni & Nelson, *supra* note 4, at 1033, 1040; Liivak, *Maturing Patent Theory*, *supra* note 10, at 1168-69. There may certainly be differences between policies focused on rewarding invention and policies focused on rewarding commercialization, but these differences are beyond the scope of this Article.

[34] *See* Mark A. Lemley, *Property, Intellectual Property, and Free Riding*, 83 TEX. L. REV. 1031, 1064 (2005) [hereinafter Lemley, *Free Riding*].

[35] *See* Pénin, *Patents Versus Ex Post Rewards*, *supra* note 3, at 643-44. For a number of references discussing the dynamic costs of awarding exclusive rights, see note 50.

[36] *See* Kaplow, *supra* note 1, at 1822; *see also* Suzanne Scotchmer, INNOVATION AND INCENTIVES 98-103.

[37] *See* Hemel & Ouellette, *supra* note 24, at 311-12; Pénin, *Patent Policy*, *supra* note 4, at 111-12; *See* Camilla Hrdy, *Local Commercialization Incentives* at ___ (2014), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2404741.

[38] *See* Adam Smith, Lectures on Jurisprudence 82-83 (R.L. Meek, *et al*., eds. 1978); Pénin, *Patent Policy*, *supra* note 4, at 112-13. More recently, scholars have questioned whether the benefits of this administrative simplicity outweigh the costs of rewarding invention by way of a patent system. *See*, *e.g*., Michael Abramowicz, *Perfecting Patent Prizes*, 56 VAND. L. REV. 115, 122-23 (2013) [hereinafter Abramowicz, *Patent Prizes*]; Steven

contribution, the patent office simply grants exclusive rights commensurate with the inventor's achievement and allows the market to sort out what those rights are actually worth.[39]

Alternatives to the patent system for rewarding invention or commercialization have analogous costs and benefits as well. For example, a system of governmentally administered cash prizes could instead be used to transfer wealth to inventors, but it would also impose administrative costs in the form of time and expense preparing prize applications, soliciting the opinions of experts, reviewing applications, and distributing rewards.[40] These grants would similarly cause deadweight losses as a result of the taxes necessary to fund the grants.[41] Whether the patent system or a prize system can achieve the desired level of wealth transfer at lower cost is a subject of much debate, and may very well depend on the time and circumstances of inventive activity.

Importantly, as far as the objective of rewarding invention or commercialization is concerned, the choice between a patent system and a prize system is merely one of cost-effectiveness.[42] If prizes or another form of direct public funding could create the same incentives to invent with lower administrative costs and deadweight losses, the patent system could be safely replaced by the competing regime.[43] And, in fact, it appears that in the United States invention and

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Shavell & Tanguy van Ypersele, *Rewards Versus Intellectual Property Rights*, 44 J.L. & Econ. 525, 539 (2001).

[39] *See* Scotchmer, *supra* note 36, at 38-40 (2004) (discussing comparative benefits of patents and prizes). The observation that patents can create incentives both to invent and to commercialize reveals one potential advantage of patents over other forms of direct rewards. Once commercialization incentives are considered, patents look like a one-step governmental intervention that goes a long way, both rewarding the initial invention and allowing the inventor to capture *additional* benefits following from continued investment in the technology. *See supra* note 33 and accompanying text. Achieving the same benefits through a system of prizes, by contrast, could require successive rounds of administrative action. However, some have argued that the existing system of early-stage patent grants does not created sufficient incentives to see an invention through to commercialization, suggesting that an additional, second-stage patent grant or extension may in some circumstances be beneficial. *See* Sichelman, *Commercializing Patents*, *supra* note 30, at 400-11; Abramowicz, *Underdeveloped Prospects*, *supra* note 33, at 1110-14; *see also* Michael Risch, *Reinventing Usefulness*, 2010 B.Y.U. L. Rev. 1195, 1248-50 (2010) (nothing that this problem could be addressed by increasing the threshold of patentability). Others have questioned the need to use the patent system to provide commercialization incentives in the first place. *See*, *e.g.*, Lemley, *Myth*, *supra* note 6, at 739-45.

[40] *See* Pénin, *Patents Versus Ex Poste Rewards*, *supra* note 3, at 644-45; Hemel & Oullette, *supra* note 24, at 361-62; Abramowicz, *Patent Prizes*, *supra* note 38, at 206-11.

[41] Hemel & Oullette, *supra* note 24, at 314; Abramowicz, *Patent Prizes*, *supra* note 38, at 201-06.

[42] *See* Pénin, *Patents Versus Ex Post Rewards*, *supra* note 3, at 645-46.

[43] *See* Hemel & Ouellette, *supra* note 24, at 312-15; *see also* Sichelman, *Commercializing Patents*, *supra* note 30, at 358-59 (2010); Kieff, *Property Rights*, *supra* note 33, at 710.

commercialization are indeed incentivized by a combination of patent- and grant-based rewards.[44]

B. Patent Policy under a Rewards-Focused Patent System

Under the rewards view, the selection of patent rules will be driven by the trade-offs highlighted above. Increasing patent term, broadening patent rights, granting patentee antitrust immunities—all of these will tend to increase the expected wealth transfer to successful inventors and commercializers, while also tending to impose additional deadweight losses.[45] In the other direction, changes in policies that limit the rights of patent holders will decrease their expected wealth transfer, while also reducing deadweight losses. In the standard rewards view, all of these rights and liabilities are essentially tradable; what one policy takes away, another policy can typically give back.[46]

In this way, there is a basic fungibility among patent policies as far as rewards go. A new antitrust immunity is theoretically interchangeable with a patent term extension—each will increase inventor rewards and impose deadweight losses.[47] As between the two, (and holding all else equal) the better policy is the one that provides the larger amount of inventor rewards at lower cost.[48] And, by extension, a policymaker could potentially improve the patent system by drastically reducing patentee antitrust immunities and increasing patent term (or vice versa). Thus a wide range of patent polices—application filing fees, patent term extensions, antitrust immunities, claim scope, and so on—implicate the same basic balancing of the net benefits of private patentee rewards versus public deadweight losses, and can be substituted one for the other as circumstances require.[49]

However, the fact that policies are formally interchangeable does not imply they are all equally desirable. As others have noted, some patent policies will be more or less likely to lead to undesirable levels of racing, vary in terms of the specific kinds of invention they incentivize, or have different consequences for incentives to create the next generation of technological improvements.[50] Still, the

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[44] *See* Hemel & Ouellette, *supra* note 24, at 306.
[45] *See* Kaplow, *supra* note 1, at 1830-32.
[46] *See* W. Nordhaus, INVENTION, GROWTH AND ECONOMIC WELFARE (1969); Richard Gilbert and Carl Shapiro, *Optimal Patent Length and Breadth*, 21 RAND J. ECON. 106, ___ (1990); Paul Klemperer, *How Broad Should the Scope of Patent Protection Be?*, 21 RAND J. ECON. 113, 114-16 (1990).
[47] *See* Kaplow, *supra* note 1, at 1855-67; Daniel A. Crane, *Intellectual Liability*, 88 TEX. L. REV. 253, 271-72, (2009).
[48] *See* Kaplow, *supra* note 1, at 1855-67; Scotchmer, *supra* note 36, at 109-11.
[49] *See* Scotchmer, *supra* note 36, at 107, 109-11 (discussing fungibility of patent term and breadth).
[50] *See* Merges & Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 869-70 (1990); Nancy T. Gallini, *Patent Policy and Costly Imitation*, 23 RAND J.

essential task confronting the rewards-focused policymaker is assembling the most cost-effective bundle of exclusive rights and immunities to incentivize the creation of new inventions.[51] While some policy levers may be more attractive answers to that question than others, almost any policy change affecting the level of inventor rewards can be offset by a corollary change in the same or a different domain.

As will be discussed in Part III, these principles of patent policymaking are markedly different than those implied by a coordination-focused view of the patent system. First, however, it is important to define what the term "coordination function" actually means.

II. DEFINING THE COORDINATION FUNCTION

For almost two centuries, the rewards function described in the prior section was the dominant (though not exclusive[52]) justification for the patent system. In more recent years, however, commentators have noted a variety of roles the patent system may serve beyond the transfer of wealth to the inventors of new technologies. Much of this literature has been motivated by a rather troubling empirical question: why do so many inventors apply for patents when so few patents turn out to have much enforcement value? After all, fewer than 2% of issued patents are asserted in court, and commentators estimate that fewer than 5% of patents are ever licensed for a royalty.[53] Moreover, in many industries, survey respondents rank patents as less important than other strategies for recouping their investment in innovation.[54] The apparent inability of the traditional rewards view to fully explain the extent of participation in the patent system has thus led scholars to search more deeply for roles the patent system may be serving in practice.[55]

ECON. 52, 53 (1992) [hereinafter Gallini, *Patent Policy*]; Abramowicz, *Underdeveloped Prospects*, *supra* note 33, at 1068-69 (2007).

[51] *See* Kaplow, *supra* note 1, at 1822.

[52] As discussed below, the disclosure justification also has a storied provenance. *See infra* II.B.1.

[53] *See* Lemley, *Rational Ignorance*, *supra* note 7, at 1501, 1507.

[54] See Richard C. Levin et al., Appropriating the Returns from Industrial Research and Development, 1987 Brookings Papers on Econ. Activity 783, 816; Edwin Mansfield, Patents and Innovation: An Empirical Study, 32 MGMT. SCI. 173, 180 (1986); Wesley M. Cohen et al., Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not) 28 (Nat'l Bureau of Econ. Research, Working Paper No. 7552, 2000), available at http://www.nber.org/papers/w7552.

[55] *See*, *e.g.*, Long, *supra* note 7, at 626-27; Pénin, *Patents Versus Ex Post Rewards*, *supra* note 3, at 642, 646-48. To be sure, in addition to the coordination-related explanations described below, there are a number of plausible answers to this question. *See*, *e.g.*, Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios*, 154 U. PA. L. REV. 1 (2005); Stuart J.H. Graham & Ted Sichelman, *Why Do Start-Ups Patent?*, 23 BERKELEY TECH. L.J. 1063, 1064-70 (2008); Bronwyn H. Hall & Rosemarie Ham Ziedonis, *The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry*, 1979-1995,

Because prior work examining alternate uses of the patent system has been largely focused on explaining the behavior of private actors, there has not been much need to distinguish the boundaries where one function of the patent system ends and the other begins. Those participating in the patent system likely do so for a blend of reasons, and a novel observation about how the patent system is being used by some actors hardly needs to be exclusive of any theory.[56] Further complicating matters, several of these functions are commonly associated with Edmund Kitch's far-reaching landmark, *The Nature and Function of the Patent System*. Although Kitch noted a variety of ways that the patent system could increase the output from resources used for technological innovation,[57] subsequent commentators have tended to discuss them all under the broad rubric of "prospect" theory, and have not consistently distinguished among the various uses Kitch specified.[58]

As a starting point for this discussion, the Article offers a specific, core definition of the term "coordination function." As used in this Article, "coordination function" refers to the voluntary exchange of technical information made in reliance on the exclusive rights of patents. This definition embraces several alternate descriptions of the patent system that have been noted by prior commentators, and which are explained in more detail in Section A. Other theories of the patent system are not as easy to categorize, and require a bit of qualification in order to determine whether they are truly coordination theories. These "it depends" theories are discussed in Section B.

A. The Core of the Coordination Function

The theory at the core of the coordination function is that patents may reduce risk in transactions around technical information. Whenever a firm shares information with value that depends on the firm's ability to control future uses of that information, it puts some of that value at risk. The recipient of the information

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32 RAND J. ECON. 101, 102 (2001); Lemley, *Rational Ignorance*, *supra* note 7, at 1504-06.

[56] *See*, *e.g.*, Long, *supra* note 7, at 637 (noting that prior explanations for patentee behavior are not incorrect, but "present an incomplete picture"); Kitch, *Nature and Function*, *supra* note 3, at 266; Dan Burk and Mark Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1615-30 (2003).

[57] *See* Kitch, *Nature and Function*, *supra* note 3, at 275-79.

[58] *See*, *e.g.*, Burk & Lemley, *supra* note 14, at 69-72; Niva Elkin-Koren & Eli Salzberger, THE LAW AND ECONOMICS OF INTELLECTUAL PROPERTY IN THE DIGITAL AGE: THE LIMITS OF ANALYSIS 83 (2013). Moreover, the term "prospect theory" is often used as a shorthand for the patent policies Kitch initially suggested these functions would imply. *See* John F. Duffy, *Rethinking the Prospect Theory of Patents*, 71 U. CHI. L. REV. 439, 440-43 (2004) (describing the "prospect features" of patent law as "the rules permitting fairly broad patents to be issued in the early stages of technical development"); Donald G. McFetridge and Douglas A. Smith, *Patents, Prospects, and Economic Surplus: A Comment*, 23 J.L. & ECON. 197, 198 (1980); Abramowicz, *Underdeveloped Prospects*, *supra* note 33, at 1068, 1082-83; Sichelman, *supra* note 30, at 345.

may breach its promises, the information may turn out to be valuable in some way not captured by the parties' original agreement, or a third party may simply intercept the disclosure. As the theory goes, a patent's *in rem* exclusivity—its ability to restrain others without needing to show a contractual relationship or even a chain of direct copying—can mitigate the risks of sharing information with a counterparty, allowing for more efficient development and exploitation of new technologies.

There are a host of potential benefits tied up in this idea of patents reducing the risk of losing control over technical information. Perhaps the simplest is that having patent protection as a fallback may reduce the costs of keeping secrets within a firm.[59] A strong patent portfolio may mitigate the risks and costs of misappropriation of confidential information, reducing the need for confidentiality agreements, physical protections, and intra-firm segregation.[60] Patents may also reduce the perils encountered when transferring information *outside* the firm.[61] Without some kind of legal backstop, it can be quite difficult to bargain and trade for a secret. In some cases (though certainly not all[62]), it is impossible to set the price for information without knowing what the information is, and of course the price may fall to zero once the prospective buyer has been given the information.[63] This creates the risk that valuable information may be inadvertently transferred without compensation during the negotiations period.[64] Patents may be able to provide an alternate source of protection around transactions, and thus facilitate the negotiated transfer of information from one firm to another.[65]

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[59] *See* Heald, *Transaction Costs*, *supra* note 3, at 488-89; Kitch, *Nature and Function*, *supra* note 3, at 279.

[60] *See* Heald, *Transaction Costs*, *supra* note 3, at 488-89; Landes and Posner, *supra* note 3, at 328. As Dan Burk and Brett McDonnell have noted, the benefits of reduced reliance on trade secrecy and other precautions can accrue to employer and employee alike. *See* Dan L. Burk and Brett H. McDonnell, *The Goldilocks Hypothesis: Balancing Intellectual Property Rights at the Boundary of the Firm*, 2007 U. ILL. L. REV. 575, 608-09 (2007). Relatedly, a strong patent portfolio may obviate the need to steer development efforts towards particular technologies or products for which secrecy is likely to be more effective. *See* Kitch, *Nature and Function*, *supra* note 3, at 279; Landes and Posner, *supra* note 3, at 328.

[61] *See* Pénin, *Patents Versus Ex Post Rewards*, *supra* note 3, at 649.

[62] *See* Burstein, *supra* note 6, at 256-57.

[63] This challenge is known as Arrow's Information Paradox. *See* Arrow, *supra* note 27, at 614-16; James J. Anton & Dennis A. Yao, The Sale of Ideas: Strategic Disclosure, Property Rights, and Contracting, 69 REV. ECON. STUD. 513, 514 (2002). And, to be perfectly clear, because the nature of information varies, this issue is more serious in some types of transactions than others. *See* Burstein, *supra* note 6, at 274; Anton & Yao, at 514-15.

[64] *See* Merges, *Transactional View, supra* note 4, at 1487-90; Janusz Ordover, *A Patent System for Both Diffusion and Exclusion*, 5 J. ECON. PERSP. 43, 50 (1991).

[65] *See* Landes & Posner, *supra* note 3, at 329; *see also* Ashish Arora, *Contracting for Tacit Knowledge: The Provision of Technical Services in Technology Licensing Contracts*, 50 J. DEV. ECON. 233, 246-47 (1996) (observing bundling of patent licenses with complementary know-how). Variants of this argument are sometimes categorized under the

But the potential risk-reducing benefits of patents are not limited to transactions for the sale of technical information itself. It can also be quite difficult to arrange for services to be performed that merely require the *use* of confidential information.[66] Because of the challenges of contracting around information, possessors of valuable non-public knowledge may abstain from otherwise mutually beneficial transactions for fear of an undesired transfer of that knowledge. For example, it may be difficult for a firm to obtain financing when the firm's prospective value depends heavily on the secrecy of its information. Similarly, a firm contemplating outsourcing some aspects of production or design may hesitate to do so, given the risk that proprietary information will be misused by its counterparty. A strong patent portfolio on the underlying technology may allow a firm to disclose specific plans based on that technology more widely, enabling greater transparency with investors, more effective outsourcing, and earlier engagement with potential partners and customers.[67]

Another way patents may facilitate collaboration is by making it easier to form and resolve joint ventures. One of the well-known risks of joining a research partnership is that the collaboration may result in the inadvertent transfer of existing information from a firm to its partners—or, conversely, may lead to the false claim by one of the partners that it owns something that in fact one of the other partners brought to the table.[68] Patents can be used to define and protect the technology that each party possessed prior to the partnership, reducing the risk of misappropriation or opportunistic behavior on the part of its collaborators.[69] On the other end of the joint venture lifecycle, patents may simplify the process of dividing the fruits of the partnership, allowing the parties to contract for future control of technology that did not exist at the time the collaboration began.[70]

In many of these roles, patents are essentially providing a solution to the various problems with using contracts to arrange transactions around information. For a host of reasons—the difficulties of describing information precisely,

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disclosure function of patents, *see*, *e.g.*, Eisenberg, *supra* note 33, at 1029-30. However, for reasons explained below, this association can be misleading. *See infra* II.B.1.

[66] *See* Kitch, *Nature and Function*, *supra* note 3, at 277.

[67] *See* Kitch, *Nature and Function*, *supra* note 3, at 277-78; Heald, *Transaction Costs*, *supra* note 3, at 498-97; Pénin, *Patents Versus Ex Post Rewards*, *supra* note 3, at 650. For a discussion on the relationship between transactions costs and vertical integration, *see* Benjamin Klein et al., *Vertical Integration, Appropriable Rents, and the Competitive Contracting Process*, 21 J.L. & ECON. 297, 298 (1978); Robert P. Merges, *Intellectual Property and the Costs of Commercial Exchange: A Review Essay*, 93 MICH. L. REV. 1570, 1573-74 (1995) [hereinafter Merges, *Costs of Commercial Exchange*]. For a discussion of similar benefits in the context of trade secrecy, *see* Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 485-87 (1974); Lemley, *Surprising Virtues, supra* note 25, at 335-36.

[68] *See* Merges, *Costs of Commercial Exchange*, *supra* note 67, at 158; Bureth, *supra* note 5, at 8-9; Pénin, *Patent Policy*, *supra* note 4, at 124; Ordover, *supra* note 64, at 55-56.

[69] *See* Pénin, *Patents Versus Ex Post Rewards*, *supra* note 3, at 650; Pénin, *Patent Policy*, *supra* note 4, at 124; Merges & Arora, *supra* note 4, at 458-59.

[70] *See* Bureth, *supra* note 5, at 8-9, 17-18.

evidentiary uncertainty, and the constraints of contractual remedies, to name a few[71]—it may be challenging to mitigate these risks by mutual agreement. This is not to say it would be impossible to conduct any transactions at all in the absence of patent protection—of course there are some transactions that will occur either way.[72] The theory, rather, is that a framework of exclusive rights can reduce the risks involved in evaluating, entering, and enforcing agreements involving the exchange of information.[73]

Patents may also be useful for facilitating information sharing in contexts where contracting is simply not an option.[74] For example, if a firm wants to make a broad announcement about an important technical development in hopes of identifying potential partners, it may not be practical to contract with all the relevant recipients to establish the terms of that disclosure—particularly if the whole point of the announcement is to discover previously unknown candidates for collaboration. Similarly, if hundreds of competitors want to collaborate to develop a new industry standard, it may very well be impossible to contractually settle exactly who-owns-what before getting down to the standard-setting work itself. A background of exclusive rights, the theory goes, may allow for smoother multilateral exchanges of information, reducing duplicative efforts, opening the development process to outside collaborators, and enabling innovations that no firm would be able to achieve on its own.[75]

All of these theories—as varied and far-reaching as they are—boil down to a simple idea: that patents may be able to facilitate the voluntary exchange of information in the shadow of their exclusive rights. In some cases, the voluntary exchange is for the patented invention itself—that is, the technology described in the patent specification that justified the patent grant in the first place. In other cases, the exchanged information consists of technical details that happen to fall within the scope of the patent's exclusivity—not only potentially helpful know-

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[71] *See* Merges, *Transactional View*, *supra* note 4, at 1491-93, 1497-98, 1503-04; Kitch, *Nature and Function*, *supra* note 3, at 278; Heald, *Transaction Costs*, *supra* note 3, at 480-81; Edmund W. Kitch, *The Law and Economics of Rights in Valuable Information*, 9 J. LEGAL STUD. 683, 690-93 (1979).

[72] *See* Burstein, *supra* note 6, at 256-57.

[73] *See* Merges, *Transactional View*, *supra* note 4, at 1484-85; Merges, *Costs of Commercial Exchange*, *supra* note 67, at 1589-91; Pénin, *Patent Policy*, *supra* note 4, at 124; Ted M. Sichelman & Stuart J.H. Graham, *Patenting by Entrepreneurs: An Empirical Study*, 17 MICH. TELECOMM. & TECH. L. REV. 111, 129-30 (2010) [hereinafter Sichelman & Graham, *Patenting by Entrepreneurs*].

[74] *See* Mazzoleni & Nelson, *supra* note 4, at 1039; Merges, *Transactional View*, *supra* note 4, at 1487-90; Kitch, *Nature and Function, supra* note 3, at 278; Fed. Trade Comm'n, To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy, at 18, ch. 3 (2003), *available at* http://www.ftc.gov/os/2003/10/innovationrpt.pdf [hereinafter FTC Report]; Bureth, *supra* note 5, at 7; *see also* Ronald J. Mann, *Do Patents Facilitate Financing in the Software Industry?*, 83 TEX. L. REV. 961, 993-96, 1013 (2005) (describing how patents can facilitate information sharing around software in a way copyrights cannot).

[75] *See* Pénin, *Patent Policy*, *supra* note 4, at 111; Landes & Posner, *supra* note 3, at 329.

how that was omitted from the original disclosure, but also further developments that might have been made well after the patent was filed.[76] Either way, these theories contemplate the voluntary exchange of technical information made in reliance on the exclusive rights of patents, and thus fall unambiguously within the definition of the coordination function given above.

B. Theories with an Element of Coordination

There are also several theories at the edge of coordination theory, uses of the patent system that are in some sense within the coordination function and in some sense not. This section introduces these potentially ambiguous cases and discusses their relationship to the core theory of the coordination function.

1. Disclosure

Of the various non-rewards justifications for the patent system, disclosure has by far the longest history. The Supreme Court mentioned disclosure as a goal of the patent system as early as 1832, and has repeatedly described disclosure as a core component of the patent bargain, sometimes even as *the* consideration offered by the patentee in exchange for exclusive rights.[77]

The challenge with this storied legacy is that "disclosure" has over time been invoked to mean two very different things. In one sense, the "disclosure function" refers to patent law's requirements that an applicant include a written description of her invention in such clear, concise, and exact terms as to enable a person skilled in the art to make and use the invention.[78] This is the traditional understanding of patent law's role in encouraging disclosure—the disclosure legally required in a patent application as part of the quid pro quo of a patent grant.[79] Under this understanding of disclosure, the success or failure of the patent system turns on what's in patent applications themselves.[80] However, in other

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[76] For a discussion how patents may enable the transfer of complementary, secret information, *see* Ashish Arora, *Licensing Tacit Knowledge*, 4 ECON. INNOVATION TECH. 41 (1995). Although in theory a firm must choose between patent protection (which requires disclosure) and trade secrecy (which forbids it), in practice this line is blurry, and many firms are able to "have it both ways" by disclosing enough to get a patent while also keeping valuable, related information as a trade secret. *See* Sichelman & Graham, *Patenting by Entrepreneurs, supra* note 73, at 136; Michael Risch, *Trade Secret Law and Information Development Incentives*, *in* THE LAW AND THEORY OF TRADE SECRECY 169 (Rochelle C. Dreyfuss & Katherine J. Strandburg eds., 2011) [hereinafter Risch, *Trade Secret Law*].

[77] *See* Grant v. Raymond, 31 U.S. 218, 247 (1832); Sinclair & Carroll Co., Inc. v. Interchemical Corp., 325 U.S. 327, 331 (1945); Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 481 (1974).

[78] 35 USC § 112(a) (2012).

[79] *See* Mazzoleni & Nelson, *supra* note 4, at 1039.

[80] *See* Lisa Larrimore Ouellette, *Do Patents Disclose Useful Information?*, 25 HARV. J. L. & TECH. 545, 557-59 (2012); Jason Rantanen, *Peripheral Disclosure*, 74 U. PITT. L. REV.

contexts, the term "disclosure function" can refer to the patent system's ability to facilitate information transfer *outside* patent documents.[81] As the theory goes, a system of *in rem* exclusive rights may facilitate publication and exchange of technical information that an owner would otherwise have needed to keep confidential to preserve its value.[82] In this understanding of disclosure, the measure of the patent system's success turns not necessarily on the quality of the disclosure contained in patent applications, but rather on the ease and frequency with which patent holders share information with the public or others in their industry as a result of having patent protection in place.[83]

Thus there are really two distinct concepts joined together under the rubric of disclosure: one in which the patent system is disclosure *forcing*, and another in which the patent system is disclosure *facilitating*.[84] And these two are rooted in quite different theories about the problem to be solved by the patent system. The disclosure-forcing argument for patenting is based on a concern that, in the absence of patents, secrecy would give inventors *de facto* exclusive control over their inventions for an indefinite period of time. From this perspective, it is preferable to give inventors time-limited exclusive rights rather than to let them keep their secrets forever. The idea is that the requirements of patent law will lure (perhaps coerce) holders of secrets to make disclosures in their patent applications that will mitigate the risk of indefinite trade secrecy.[85] As a result, this theory lacks a voluntary disclosure of technical information made in reliance on patent-based

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1, 5 (2012); *The Disclosure Function of the Patent System (or Lack Thereof)*, 118 HARV. L. REV. 2007, 2014 (2005); C.T. Taylor & Z.A. Silberston, THE ECONOMIC IMPACT OF THE PATENT SYSTEM: A STUDY OF THE BRITISH EXPERIENCE 210-13 (1973); Sean B. Seymore, *The Teaching Function of Patents*, 85 NOTRE DAME REV 621, 623-27 (2010).

[81] *See* Pénin, *Patents Versus Ex Post Rewards*, *supra* note 3, at 651 (making this distinction).

[82] *See* Mazzoleni & Nelson, *supra* note 4, at 1039-40.

[83] *See* FTC Report, *supra* note 74, at 18, ch. 3 (making a similar distinction); Burk & McDonnell, *supra* note 60, at 610; *Disclosure Function, supra* note 80, at 2014; Lemley, *Myth*, supra note 6, at 745-49.

[84] *Cf.* Rantanen, *supra* note 80, at 6-7 (making a similar distinction).

[85] Concern for this ability to force disclosure in patent applications has featured prominently in the Supreme Court's preemption analysis in this field. *See* Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 480-92 (1974); Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 150-56 (1989). A number of commentators have questioned whether the disclosure-forcing aspects of patent can offer a satisfying, freestanding justification for the patent system. *See*, *e.g.*, Eisenberg, *supra* note 33, at 1029-30; Sichelman, *supra* note 30, at 377-78. As a result, the more common view is to explain the disclosure requirements as a rational policy choice in view of *other* theories that justify having a patent system. *See* Jeanne Fromer, *Patent Disclosure*, 94 IOWA L. REV. 539, 548-49 (2009) (arguing it may be worthwhile to compel disclosure as a condition of the patent grant to stimulate further development and assist others attempting to invent around the patented technology during the patent term); Lemley, *Surprising Virtues*, *supra* note 25, at 332 & n. 87; Ouellette, *supra* note 80, at 557.

exclusivity, and falls outside the scope of the coordination function as defined above.

The disclosure-*facilitating* argument for patenting, by contrast, is focused on the concern that, in the absence of patents, the risk of losing control over useful technical information would force firms to maintain this information as a secret notwithstanding existing reasons for those firms to share it with others. The goal of facilitating disclosure is not to artificially encourage disclosure for its own sake, but rather to enable the exchange of information when it is already privately desirable to do so.[86] Reduced to this description, the disclosure-facilitating justification for the patent system falls squarely within the coordination function as defined above, since it contemplates the voluntary exchange of technical information made in reliance on patent exclusivity.[87]

This divergence only underscores the need for greater clarity about what is meant by "disclosure." Unspecific use of this term unhelpfully conjoins two distinct theories of the patent system, and thus leads to indeterminate or conflicting implications for patent policy.[88]

2. Signaling

Another function that may be served by the patent system is signaling. However, as with disclosure, the signaling view of patents actually embraces multiple theories of operation, some of which fall within the coordination function and some of which do not. As a result, discussion of patent "signaling" requires further elaboration before one can confidently classify it as being with the coordination function or outside it.

One understanding of signaling is rooted in the challenges outsiders face in verifying information about a firm's capacities for research and development. For example, two firms may both claim to be leaders in the same field, making it difficult for investors, potential employees, and partners to identify which is actually the better prospect. According to this theory, a firm can signal its strength by investing in patents.[89] As between the two firms claiming to be leaders in their field, the one with stronger research and development capabilities will find it profitable to file more applications, and over time will tend to be awarded more patents.[90]

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[86] *See* Mazzoleni & Nelson, *supra* note 4, at 1039; Rantanen, *supra* note 80, at 20.
[87] *Cf*. Rantanen, *supra* note 80, at 36.
[88] *Cf*. Rantanen, *supra* note 80, at 39-40.
[89] *See* Long, *supra* note 7, at 637; Jessica Silbey, *Patent Variation: Discerning Diversity Among Patent Functions*, 45 LOY. U. CHI. L.J. 441, 458-60 (2013).
[90] *See* Long, *supra* note 7, at 650, 667. Long additionally noted that information contained in patent applications may be more reliable than other sources because applicants are subject to a duty of candor in patent proceedings. *Id*. at 649-50.

Notably, this first version of signaling theory does *not* rely on the ability of those issued patents to exclude others from using any particular technology.[91] Rather, the signaling function operates based on a perceived correlation between a firm's ability to obtain patents and other, more-difficult-to-observe characteristics of the firm.[92] If this form of signaling were the only function of the patent system—a claim, to be clear, proponents of this theory do not typically make[93]—there would be no need to include the exclusive rights at all.[94] For example, the same problems of verifying technical achievement could be addressed by a system of peer-reviewed honors wholly apart from patenting.[95] And, because this version of the signaling theory does not depend on the exclusive rights conveyed by a patent to enable the transfer of technical information, it falls outside the definition of the coordination function given above.

However, there is another understanding of signaling that complicates the story somewhat. This alternate signaling theory is rooted in the difficulties firms face identifying potential partners in the development of a nascent technology. Unlike real property, where it may be easy to observe what neighbors are doing, researchers in a technical field may be unaware of potential collaborators performing similar work. This can lead to duplicative investment, increased search costs, and incompatible technologies.[96] A publicly recorded patent right, the theory goes, may provide a "beacon" to other in the industry, allowing potential partners to find each other and cooperate at an earlier stage of the development cycle.[97]

The proper classification of this latter signaling theory turns on the following question: why exactly do private firms need a government-issued patent right in order to find each other? If the answer is that firms need help identifying *competent* partners in a particular technology area,[98] then this latter form of signaling is no different than the former—both are rooted in the problem of conveying information credibly, and both could be addressed without legal rights to exclude (for example, by a system of peer-reviewed honors). But if the answer is that, without exclusive rights, it will be too risky for firms to share the information necessary to find (and be found by) potential partners, then this latter form of

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[91] *See* Long, *supra* note 7, at 636-37.
[92] *Id*.
[93] *See*, *e.g.*, Long, *supra* note 7, at 637.
[94] For a discussion of the interplay between exclusive rights and the signaling function of patents, *see* Mann, *supra* note 74, at 1022.
[95] For example, significant technical or academic accomplishments could be recognized by a system of prestigious prizes. *See*, *e.g.*, Nobelprize.org: The Official Website of the Nobel Prize (available at http://www.nobelprize.org); Fields Medal Details (available at http://www.mathunion.org/general/prizes). *See also* Pénin, *Patents Versus Ex Post Rewards*, *supra* note 3, at 651.
[96] *See* Kitch, *Nature and Function*, *supra* note 3, at 278.
[97] *See* Kitch, *Nature and Function*, *supra* note 3, at 278; F. Scott Kieff, *IP Transactions: On the Theory & Practice of Commercializing Innovation*, 42 HOUS. L. REV. 727, 735 (2005); Kieff, *Coordination*, *supra* note 8, at 414.
[98] *See*, *e.g.*, Bureth, *supra* note 5, at 8 (discussing signaling in this way).

signaling is really a restatement of the disclosure-facilitating theory described above. Under this view, the enforceability of patent rights is essential, and this kind of signaling is within the domain of the coordination function.

So while both of these signaling theories relate to the more efficient exchange of information, they are actually rooted in quite different stories of market failure. If "signaling" refers to the challenges of conveying information credibly, then patents are but one form of prize that could be used to identify technical competence. But if "signaling" refers to challenges of disclosing information without losing control over it, then the exclusive rights of the patent system are essential to addressing the problem. The latter is within the coordination function, the former is not.[99]

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To summarize, three general theories discussed by commentators fall within the definition of the coordination function given above: 1) patents can reduce of risk in bilateral transactions around information; 2) patents can facilitate multilateral collaboration; and 3) patents can facilitate broader voluntary disclosure. These theories are not without controversy; to the contrary, many commentators vigorously dispute whether patents should or do serve these roles.[100] But joining these various uses of the patent system into a unified theory is the first step towards understanding what pursuing these goals would practically entail, *if* it turns out such a move is actually desirable.

The various theories within the coordination function share a rather humble charter: reducing costs and risks so that otherwise privately desirable transactions can occur. This is in contrast to rewards-style uses of the patent system, which typically seek to stimulate some desired conduct through the promise of a publicly funded quid pro quo.[101] Rather than subsidizing some desired conduct (say, a valuable patent in exchange for invention), the coordination function merely seeks to facilitate output-enhancing interactions among private actors.[102]

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[99] It may seem counterintuitive that some forms of signaling are within the coordination function and others are not. However, the literature surrounding both of these theories are actually quite explicit—and explicitly different—about how they view patent-backed right's to exclude. The core contribution of the first signaling theory is that the value promised to successful inventors may come from sources *other than* a patent's legal right to exclude. *See* Long, *supra* note 7, at 636-37. By contrast, proponents of the latter signaling theory have emphasized the critical importance of property-like rights to exclude. Kieff, *Coordination*, *supra* note 8, at 354.

[100] *See*, *e.g.*, Burstein, *supra* note 6, at 246-47, 262; Lemley, *Myth*, *supra* note 6, at 748; Feldman & Lemley, *Does Patent Licensing Mean Innovation*, *supra* note 6, at 139.

[101] *See supra* II.A.

[102] Some policy goals may straddle both theories. For example, the role the patent system plays in facilitating commercialization may include both rewards and coordination

This distinction in goals is significant, because it leads to very different policy substitutes. While the problems solved by the rewards function of the patent system could alternatively be addressed through a system of prizes, the problems solved by the coordination function could not. So if a policymaker wanted to, say, increase incentives to commercialize undeveloped inventions (a rewards goal), she could institute a cash grant program that might reward commercialization just as effectively as the patent system.[103] But, importantly, these grants wouldn't address coordination problems—they wouldn't facilitate privately valuable information sharing, or otherwise reduce the costs and risks of transactions around technology.[104] Prizes and grants may be able to substitute for the rewards function of patents, but they cannot do they same for the coordination function.[105]

The rewards and coordination functions do not only diverge in the policy tools that can substitute for them outside the patent system. As the next part

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components. Patents may reduce free-riding and create incentives to invest in commercialization—at heart a rewards theory. Patents may also enable broader disclosure and facilitate the transactions necessary to move early-stage technologies from inventors to commercializers—at heart a coordination theory. *See* Mazzoleni & Nelson, *supra* note 4, at 1040; Landes & Posner, *supra* note 3, at 329. For a dialogue regarding this distinction, *see* Ted Sichelman, *Commercialization Information with Intellectual Property*, 92 TEXAS LAW REVIEW SEE ALSO 35, 41 (2014); Michael Burstein, *Reply—Commercialization without Exchange*, 92 TEXAS LAW REVIEW SEE ALSO 45, 46 (2014). And some benefits may resist categorization as *either* rewards or coordination. For example, Kitch famously argued that patents can reduce competition for innovation—and that this reduction in competition can actually lead to more efficient development of new technologies. *See* Kitch, *Nature and Function*, *supra* note 3, at 276; Scotchmer, *supra* note 36, at 152 (summarizing Kitch's theory); *see also* Merges & Nelson, *supra* note 50, at 872-74 (disputing the theory); Mark A. Lemley, *Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 1048-58 (1996) [hereinafter Lemley, *Economics of Improvement*] (same). Unlike the rewards and coordination theories, this idea isn't rooted in the difficulties of excluding other from uses of information at all. In fact, the generalized form of the supposed problem—overinvestment in entry—can occur in situations having nothing to do with information or emerging technologies. *See* Michael Abramowicz, *An Industrial Organization Approach to Copyright*, 46 WM. & MARY L. REV. 33, 48-55 (2004) (describing an example of overinvestment in the construction of gas stations).

[103] *See supra* note 37 and accompanying text.

[104] *See* Pénin, *Patents Versus Ex Post Rewards*, *supra* note 3, at 653-54. It's true that a prize could be conditioned on collaboration with other participants. But even if such a requirement resulted in more exchange, this wouldn't mean it had necessarily solved any coordination problems. The goal of the coordination function is to enable information exchanges with existing private benefits, not to induce information exchange for its own sake. *See supra* note 86 and accompanying text.

[105] This concern about the availability of policy substitutes is particularly timely, in light of recent scholarship reevaluating the possibility of addressing rewards problems through an increased reliance on non-patent mechanisms. *See*, *e.g.*, Hemel & Ouellette, *supra* note 24, at 304-07. If the rewards role of patents were to be significantly displaced by these other policy tools, it is the (potential) coordination benefits of patents that would be left behind.

explains, they also have quite different policy implications when these goals are addressed *by* the patent system.

III. THE COORDINATION FUNCTION: FROM THEORY TO MID-LEVEL PRINCIPLES

The prior section surveyed a wide array of alternative uses of the patent system and synthesized a core definition of the coordination function. But, as others have noted, it is one thing to state these potential benefits of the patent system, and another thing to understand what coordination-focused policy would actually require.[106] This part explores the coordination theory in more detail to identify the characteristics of the patent system that are important for coordination and those that are not.

A. What Does the Coordination Function Require?

To understand what the coordination function requires to operate, it is first necessary to establish what it would mean for the patent system to serve this function well. As discussed above, the goal of the coordination function is to facilitate output-enhancing information exchange among private actors by reducing the risk that exchanged information will later be used in ways its original possessor did not intend.[107] The theory is that a backdrop of exclusive rights will allow firms with confidential information to reduce precautions and share that information more freely when it is beneficial for them to do so. Therefore, on the theory's own terms, success is measured by the amount of privately beneficial information sharing that occurs in reliance on patent rights.

So which characteristics of the patent system determine whether a lot or a little patent-backed information sharing will occur? To answer this question, consider the share-or-conceal decision from the perspective of a firm possessing some valuable technical information.[108] The firm could obtain some benefits by choosing to share this information.[109] But those benefits are counterbalanced by a

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[106] See Landes & Posner, supra note 3, at 330-31; Pénin, Patent Policy, supra note 4, at 125 (both observing need for more development in this area).

[107] *See supra* ___.

[108] Throughout this discussion, the term "information sharing" is used to include both a deliberate transfer of information and a reduction in precautions to prevent transfer. Each is a decision by a firm to loosen its grip on some valuable information.

[109] Because the goal of the coordination function is only to enable information exchange that is already privately desirable, the benefits of sharing exist by hypothesis. If there are no private benefits to sharing information, then no sharing will occur, and the coordination function will not seek to alter this result. Similarly, if there are no risks of loss to begin with, the firm will share the information with or without patent protection, and the coordination function is again irrelevant. It is the marginal cases—where benefits were available but overshadowed by risks—that the coordination function seeks to affect.

risk that the information's value will be diminished through a future loss of control.[110] The essential choice facing the firm is whether the expected benefits of sharing this confidential technical information exceed the expected loss that may occur from future unplanned use by others.

In a world without patents, the decision to share any particular piece of information is a straightforward one. The firm must simply compare the expected benefits of information sharing to the expected harms from that could result from losing control over that information. When the benefits of sharing are large compared to the value of the information in question, the firm will elect to share.[111] For example, the benefits of telling customers some general details about new products likely far exceed the downside of competitors learning the same information. But when the benefits of sharing are smaller compared to what the firm stands to lose, secrecy is the better path. For example, even if a firm could make additional sales by showing customers its complete design schematics, the the risk of losing control over such information is usually too great to justify this level of transparency.[112]

The goal of the coordination theory is to influence this balancing, allowing the firm to engage in more privately beneficial information sharing than it otherwise would. Patents do this, the theory goes, by reducing the expected loss the firm faces from engaging in information sharing. If the firm elects to share its confidential information and later discovers the information being used in a way it does not approve of, it can bring a patent suit to attempt to restore some of the exclusivity value it enjoyed before disclosure occurred. If the patent suit is successful, the firm will be eligible for remedies that may compensate for some portion of the exclusivity value lost through disclosure.[113] In this way, the

[110] Call the benefits of the information sharing B and the control-dependent value that will be lost due to unplanned divulgence S. Divulgence occurs with a probability d. Sharing information thus gives the firm a certain benefit B, but also an expected loss given by dS.

[111] Using the terms introduced in the prior footnote, the firm will engage in the information-sharing activity provided that the expected benefits of the activity outweigh the expected risk of losing the information's control-dependent value, that is, so long as $B > dS$.

[112] The condition $B > dS$ can be written as $S < \frac{B}{d}$. Then, holding d constant, the smaller the control-dependent value (S), the easier it will be for information sharing to be worth the risk. Therefore, firms can be expected to more cautious the more valuable the information.

[113] Bringing a patent infringement suit against those using the previously confidential information will impose a positive enforcement cost (C), but offer a probability (p) of restoring some amount of exclusivity value (X). So, whereas divulgence used to mean a loss of the full value of the original control-dependent value (S), it will now result in a loss of $S + C$, potentially offset by patent-based exclusivity with expected value pX.

downsides the firm faces from sharing its information are reduced, potentially allowing more privately beneficial information exchanges to occur.[114]

For example, consider a firm that has just finished designing its latest product. The firm could manufacture the product itself, or it could hire an outside company to do it. In this hypothetical, outsourcing would allow the firm to make each unit more cheaply, but require disclosing the firm's valuable design plans to an outside party.[115] This creates a risk that the plans may end up in the hands of a competitor, destroying much of their value to the firm.[116] To a certain extent, the firm can seek to avoid this result by choosing an outsourcing partner with a good reputation and putting strict non-disclosure terms in the contract, but such precautions can only go so far. The expected benefits of outsourcing come with some risk that the plans will be disclosed or used in way that harms the firm.

So the firm must weigh these expected benefits and risks of harm. In the absence of patents, the firm will outsource only if the expected benefits of doing so are large compared to the probability and magnitude of harm to the firm from unplanned disclosure.[117] But if the firm has the option of bringing a patent infringement suit in the event of unplanned disclosure, it enjoys a chance of restoring some of the exclusivity value that was lost as a result of the unplanned disclosure.[118] This infringement-suit option can mitigate the firm's losses and reduce the downside risk from sharing information. As a result, the firm may more outsourcing opportunities worthwhile than it would in the absence of patent protection.[119]

Viewed from this perspective, the patent system's success in enabling information sharing turns on the ability of patents to reliably restore a firm to the

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[114] With a patent strategy to use as a fallback, the firm will now share the information so long as $B > d(S - pX + C)$ that is, provided $S < \frac{B}{d} + pX - C$. On certain conditions (discussed below), patents can raise the threshold on the right side of that inequality, allowing more information sharing to be worth the risk. A related effect may reduce the likelihood that the firm's information is put to unapproved uses in the first place. Specifically, if the firm can reliably bring a patent suit against those who use the disclosed information without the firm's permission, other parties may be deterred from misappropriating the information in this way.

[115] In this example, the benefits to the firm of outsourcing are B.

[116] The probability that a competitor will obtain the plans is d, and the loss to the firm from this occurring is S.

[117] As in the generalized form of the model, the firm will only take this risk if $B > dS$.

[118] Specifically, the firm now faces a probability p of restoring X of the lost control value through patent remedies.

[119] In terms of the model, the possibility of patent protection allows the firm to take this risk whenever $S < \frac{B}{d} + pX - C$. So long as $pX > C$, the possibility of patent protection allows more outsourcing opportunities to pass this test. And because patent enforcement is always at the firm's option, when $pX < C$, the firm will simply ignore its patent portfolio, and make its information sharing decisions as it would in the absence of patents.

position it would have enjoyed under secrecy. A maximally effective (though not necessarily cost-justified) coordination-focused patent system would give the firm a zero-risk right to restore its prior exclusivity after disclosure has occurred. This would allow a firm to have the best of two worlds: all the benefits of disclosure and engagement with others, while at the same time enjoying all the control and exclusivity value afforded by secrecy. Such airtight patent rights combined with powerful remedies would moot the share vs. conceal question entirely, allowing information sharing to occur whenever there is any benefit to doing so.[120]

When patent rights provide something less than that, their effect is to reduce, rather than eliminate, the risks firms face when they elect to share their information. First consider the possibility that the remedies provided by patent law may be less valuable to the firm than the control the firm previously enjoyed under secrecy.[121] There are a number of reasons this is likely to be true: patent rights are temporally and geographically limited; the scope of patent protection may be vulnerable to circumvention; a court may refuse to enter an injunction. In that case, the firm still faces some potential downside from sharing its information—if future unplanned use occurs, it gets patent remedies, which fail to fully restore the firm to its prior position. When this occurs, patents alleviate some, but not all, of the risks of sharing information.[122]

Another way patent rights may leave firms with some residual risk from information sharing is from the failure of those rights themselves. When a future unplanned use of the shared information occurs, the firm can only mitigate its losses with patents if it has a good chance of actually prevailing in an infringement suit. But there are a number of ways the user of the information may escape liability entirely. She may find ways to use the information that do not infringe the patent. She may show that the scope of the claims is narrower that it appears. She may succeed in defeating the validity of the patent itself. The availability of these arguments introduces the very real possibility that a patent may later to turn out not to provide any protection at all.[123] As with weaker patent remedies, the risk that patent protection will fail leaves a firm contemplating disclosure holding some of the risks of loss.[124]

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[120] To see this, remember that a firm will share its information when $B > d(S - pX + C)$. When C approaches 0 (patents remedies are cheap to obtain), p approaches 1 (exclusion is guaranteed), and X approaches S (patent remedies restore all control-dependent value), the downside risk of sharing is effectively eliminated, and any information-sharing opportunity with positive benefit ($B > 0$) will satisfy the condition.

[121] In terms of the model, the remedies provided by patent law, X, are something less than S.

[122] Because $X < S$, the equation in note 120 indicates that B must be larger than some number, call it T, where $T > 0$. This suggests some otherwise beneficial information sharing will not occur—cases where $0 < B < T$.

[123] In terms of the model, the probability of obtaining patent remedies is given by p.

[124] A decrease in the probability of obtaining patent remedies has a similar effect as a decrease in the value of the remedy itself, *see supra* note 122. As p gets smaller, there is a

Thus, the theory of the coordination function's operation reveals two critical dependencies: the reliability of patent rights and the ability of those rights to provide secrecy-like exclusion. When patents provide a high likelihood of obtaining secrecy-like exclusion, they will induce a large amount of patent-backed information sharing, and the coordination function will be at its peak. Conversely, if the likelihood of a patent victory is low and patent remedies are weak, the patent system will fail to offer much comfort in the case of inadvertent disclosure, and very little patent-backed information sharing can occur.

B. Several New Degrees of Freedom

The generalized form of the coordination theory described above leads to two requirements that have a significant affect on the coordination function's effectiveness: reliable patent rights and secrecy-like exclusion. These aren't particularly surprising, for the same characteristics would increase the effectiveness of the rewards function as well.[125] However, the more interesting aspects of the coordination story are found in what it *doesn't* say. This section highlights the ways that the operation of the coordination function described above departs from that of the traditional rewards function.

1. No Direct Reliance on the Initial Allocation of Patent Rights

As described above, the coordination function offers a firm an alternative means of excluding others from using confidential information after it is purposefully or inadvertently transferred. To serve this function, patents need to create predictable rights of sufficient scope to enable firms to reliably backstop their private arrangements around information. But, notably, nothing in the framework above depends on the initial allocation of patent grants. This feature of the coordination function relaxes several conditions that are necessary for a well-functioning rewards system.

When it comes to the traditional rewards function, the initial allocation of patent rights is critical. The work of the rewards function is, after all, to increase incentives to invent by transferring a thing of value to those who successfully produce a new invention.[126] Errors in the initial allocation of patents directly frustrate this goal, because they weaken the relationship between the desired

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reduction in the number of incremental information sharing opportunities enabled by patent protection. Note that, in some cases, generous patent remedies (X) may be able to offset small probabilities of patent victory (p), but even this has its limits. First of all the ability of patent courts to provide exclusion isn't infinite—patent remedies are necessarily limited by time, geography, and technical scope. Second, even when strongly exclusionary remedies are feasible, the risk aversion of patent holders may prevent generous remedies from completely offsetting low likelihoods of victory.

[125] In this context, "effectiveness" refers only to the power of the incentives offered to the inventors of first-generation technologies. This does not imply that such maximalism constitutes optimal rewards-focused patent policy. *See supra* I.B.

[126] *See* Mazzoleni & Nelson, *supra* note 4, at 1033, 1035.

conduct (invention) and the promised reward (a patent).[127] As a result, the rewards function implies a compelling interest not only in granting patents to those who deserve them, but in denying them to (and perhaps revoking them from) those who do not.

As the coordination function does not seek to incentivize private conduct through the promise of a prize, it has no direct dependence on the initial allocation of patents. Instead, what matters is the final allocation—that patents ultimately end up in the hands of parties who can rely on them to transfer technical information. Though the policy implications are more complex,[128] at a theoretical level the coordination function could be just as well served by a system that allocates patents randomly and makes them easy to trade as it could by a system that allocates patent cautiously.

One way of looking at this distinction is that some version of the Coase theorem is applicable in the case of coordination, but not in the case of rewards. Under the coordination view, if rights are inefficiently allocated, private negotiation is available to reach a more efficient configuration.[129] This process won't be free—there will certainly be transaction costs in identifying partners and negotiating the trade. But when it comes to the rewards function, mistakes in allocation cannot be solved by Coasian bargaining at all. The purpose of the patent grant is to affect distribution, so it's no comfort to say that the parties can trade after the fact.

Particularly when the costs of trading patents are high, the coordination function may still justify a resource-intensive effort to try to put patents in the proper hands from the beginning. But the significance of the initial allocation of patents is indirect; it matters only to the extent it affects the final allocation of patents and the costs of reaching that state. This is in sharp contrast to the rewards

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[127] *See* Abramowicz, *Patent Prizes*, *supra* note 38, at 180 (noting that a prize system requires some method of identifying worthwhile innovations and rejecting others). This can happen through mistakes in either direction. For example, when a patent is improperly denied to a rightful inventor, ex ante incentives to invent are reduced, since inventors face an increased risk that even if they succeed in achieving a patentable invention, they will nonetheless be denied their reward. *See* Andres Sawicki, *Better Mistakes in Patent Law*, 39 Fla. St. U. L. Rev. 735, 762 (2012). Going the other way, a patent that is improperly granted also reduces incentives to invest in invention, because it introduces the possibility that an applicant will get the prize of a patent whether or not she deserves it. The incentives to invest in invention—the very core of the rewards function—thus depend both on the likelihood that a patent will be granted if an invention is achieved and on the likelihood that a patent will not be granted if an invention is not achieved.

[128] *See infra* IV.A.

[129] *See* Mark A. Lemley, *Reconceiving Patents in the Age of Venture Capital*, 4 J. SMALL & EMERGING BUS. L. 137, 147-48 (2000) (applying Coase in this way); Guido Calabresi and A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089, 1094-95 (1972) (discussing similar implications).

function, where accuracy in the initial allocation of patents is critical to the function's success.

2. No Intermediate Goal of Wealth Transfer

The theory of the coordination function described above is in many ways less ambitious than the traditional rewards function. All that is necessary for the coordination function to succeed is the creation of reliable, private rights to exclude others from using a particular body of information. Allocating these rights to private parties may well have other effects: distributional consequences, the creation of market power, subtle pressures on industry structure, just to name a few. But these consequences are collateral, and as a result, a policymaker may find she has many more latitude implementing the coordination function than she does when it comes to the rewards function.

As the reward function seeks to directly incentivize investment in research and development by the offer a patent prize, it is inherently sensitive to the total *ex ante* value proposition offered by the patent system.[130] For example, an increase in the costs of acquiring or maintaining a patent will reduce the value of the patent package—particularly because the costs of securing a patent are certain to be incurred, and the potential benefits of successful enforcement of that patent are probabilistic.[131] Similarly, it is critical that at least *some* patents result in monopoly rents sufficient to justify the persistent costs and risks of investing in research and participating in the patent system.[132] If the total package of costs and benefits offered by the patent system does not result in some expected benefits when an invention turns out to be a success, the patent system will fail in its goal of creating additional incentives to try.[133]

The coordination function does not depend on any such promise of riches, which opens up a variety of policy options that would not be possible under the rewards function. For one, there is no need to distribute patents as privately valuable grants—they could be allocated by auction, for instance, allowing competitive bidding to reduce the private surplus inherent in patent issuance.[134]

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[130] *See* Abramowicz, *Patent Prizes*, *supra* note 38, at 124; Liivak, *Maturing Patent Theory*, *supra* note 10, at 1165.
[131] *See* Stephen Yelderman, *Improving Patent Quality with Applicant Incentives*, 28 HARV. J.L. & TECH. 77, 93 (2014).
[132] *See* Dennis D. Crouch, *The Patent Lottery: Exploiting Behavioral Economics for the Common Good*, 16 GEO. MASON L. REV. 141, 142-43 (2008); Mark A. Lemley & Mark P. McKenna, *Is Pepsi Really A Substitute for Coke? Market Definition in Antitrust and IP*, 100 Geo. L.J. 2055, ___ (2012).
[133] However, these benefits need not flow exclusively from wealth transfer. *See* Long, *supra* note 7, at 636-37.
[133] However, these benefits need not flow exclusively from wealth transfer. *See* Long, *supra* note 7, at 636-37.
[134] *See* Harold Demsetz, *Why Regulate Utilities?,* 11 J.L. & ECON. 55, 63 (1968). For a thorough discussion on the costs, benefits, and feasibility of allocating patents by auction,

And even once patents are issued, their role in coordination is simply to allow firms to restore the exclusivity value of information the firm already possesses. Some changes in the scope, duration, or intensity of patent rights may not affect the coordination function at all, provided they leave intact this core ability to reliably restore exclusivity.

As with the prior observations about the coordination function, this theoretical distinction does not imply there are no practical limits. Some changes affecting patent value may not impair the coordination function, but others will. For example, a dramatic increase in the standards of patentability may weaken the coordination function (as well as rewards), since the exchange of technical information in reliance on patents depends on having an adequate stock of patents in circulation upon which to rely. So, if heightened patentability standards make patents too difficult or expensive to obtain, firms may forgo the coordination function of patents and rely on secrecy instead. The lack of a wealth-transfer goal opens up a variety of policy options, but the requirements of the coordination function nonetheless imply some constraints.

3. The Possibility of Independent Derivation

The success of the patent system in serving the coordination function depends on its ability to restore the possessor of confidential information to the state it was in before making any disclosure. Once the consequences of the disclosure are effectively undone—for example, the recipient of the initial disclosure and anyone who learned of the information from them have been restrained from using or further disclosing the information—it makes no difference whether others somewhere in the world are still using the patented technology. The effectiveness of the coordination function does not depend on patent holders having a right to exclude those who came upon the same information independently.

This is in contrast to the rewards function, where the ability to exclude independent third parties is an important determinant of the value of patent rights and therefore the system's success. If a patent only included the right to exclude copyists, the prize for achieving a successful, patentable invention would be significantly smaller.[135] From the perspective of the rewards function, this change in the private value would provide a weaker incentive to engage in research and participate in the patent system.[136]

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see Michael Abramowicz, *The Uneasy Case for Patent Races over Auctions*, 60 STAN. L. REV. 803 (2007).

[135] *See* Mark A. Lemley, *Should Infringement Require Proof of Copying*, 105 MICH. L. REV. 1525, 1529-30 (2007).

[136] There may be situations where the costs of providing such far-reaching exclusion exceed the benefits, but this is at heart a cost-minimization tactic. For balancing of incentives to invent and social costs in the context of near-simultaneous invention, *see* Samson Vermont, *Independent Invention as a Defense to Patent Infringement*, 105 MICH. L. REV. 475, 489-

The success of the coordination function does not turn on the private value of patents, so a reduction in the number of potential infringers would not necessarily affect its success. Instead, there is a core story of a time and place where patents must be reliably available to provide secrecy-like exclusion. Outside of that time and place, the coordination function does not depend on the patent holder having a right to exclude at all.

This potential exception is in some ways similar to the independent invention defense that has been proposed by commentators or to the prior user defense recently created by the America Invents Act.[137] But there are important differences as well. To illustrate, consider a Firm A that sends some design plans out for bid in reliance on its patent portfolio. Firm B receives the bid package, but instead of agreeing to work with Firm A, decides to steal the plans and compete directly against Firm A. Firm A resorts to its patent back-up plan, asserting various patents against Firm B in hopes of restoring the exclusivity it originally enjoyed in its design plans.

As traditionally conceived, an independent invention or prior user doctrine could give Firm B a potential defense on these facts. When Firm A asserts a patent, Firm B would have the opportunity to show that it previously independently conceived and reduced to practice Firm A's claimed invention.[138] If so, Firm A would have no patent remedies against Firm B. But for purposes of the coordination function, inquiring about the origin of the *claimed invention* is the wrong question. Rather, the inquiry must focus on whether Firm B independently created the previously *confidential information* (here, the design plans) before it came into contact with Firm A. Because Firm B took its design plans from Firm A, it should not be able to invoke an independent derivation defense, even if it may have independently invented the subject matter of Firm A's patents some time before.

In the other direction, there are situations in which the independent derivation defense would apply and these other defenses would not. For example, independent invention and prior use typically require that the defendant conceived of the invention either before or around the same time as the plaintiff did.[139] But for

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90, 493-94 (2006); Carl Shapiro, *Prior User Rights*, 96 AM. ECON. REV. 92, 95 (2006); Stephen Maurer & Suzanne Scotchmer, *The Independent Invention Defense in Intellectual Property*, 69 ECONOMICA 535, 540-42 (2003).

[137] *See*, *e.g.*, Vermont, *supra* note 136; Shapiro, *supra* note 136; Maurer & Scotchmer, *supra* note 136. The prior user defense created by the America Invents Act ("AIA") is codified at 35 U.S.C. § 273.

[138] Vermont, *supra* note 136, at n. 484-86. In other formulations, the defendant would be required to demonstrate steps towards commercialization as well. *See* Lemley, *supra* note 135, at 1533-34. Under the AIA, Firm B would need to show that it used the claimed invention commercially in the United States at least a year prior the patent's filing date. *See* 35 U.S.C. § 273(a).

[139] The AIA requires the defendant had a commercial use at least a year before the plaintiff's filing date. *See* 35 U.S.C. § 273(a). Other proposals are more forgiving, but

independent derivation, the critical date is the day the plaintiff encountered the defendant's disclosure. So if Firm B independently created some design plans well after Firm A filed a patent, but before Firm B had any opportunity to copy Firm A's design plans, the independent derivation defense should be available. For purposes of the coordination function, all that matters is that Firm B did not obtain its design plans from Firm A.

Caution is in order here. The case for the coordination function is rooted in the problems of proof when it comes to tracing the flow of information. Therefore, an independent derivations defense would need to be carefully crafted to avoid losing the benefits of the patent regime in the first place. For example, if the patent holder was required to prove that the defendant obtained a particular piece of valuable information from the patent holder, the coordination function might have little ability to facilitate publication or multilateral exchange. The claimed advantage of patent rights to facilitate information exchange comes at least in part from the fact that they are presumptively *in rem*, not requiring proof of direct copying. But, at least as a theoretical matter, that *in rem* default can bend a little bit. Cabined properly, an independent derivation defense does not necessarily undermine the goal of the coordination function.

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Given these observations, a purely coordination-focused patent system could look radically different from the patent system as it exists today. In some ways, the design of this hypothetical new system would be more constrained—the success of the coordination function depends critically on patents constituting reliable rights that provide strong, secrecy-like remedies. But in other ways the demands of the coordination functions are more flexible. Patents could be handed out randomly, or initially allocated by a public auction. Changes could be made affecting their private value, so long as the core rights of reliable exclusion were preserved. The infringement claim could be opened to new defenses, carving out third-parties who had no prior contact with the patent holder. On the whole, it's not useful to say whether patent rights would be stronger or weaker under a purely coordination-focused regime. What is clear is that equivalence between coordination- and rewards-focused policies should no longer be presumed.

IV. IMPLICATIONS FOR PATENT POLICY

As the prior parts discussed, the coordination function is not a simply an alternative justification for the patent system, a stand-in for rewards theory that will naturally lead policymakers to the same prescriptions. Rather, the coordination function is focused on an entirely different kind of information failure, leading to a distinctive theory of operation and divergent principles of what the patent system should offer patent holders. If one were to scrap existing patent law and build a

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nonetheless terminate the possibility of independent invention at some constructive notice date. *See*, *e.g.* Vermont, *supra* note 136, at 486-87.

coordination-focused regime from scratch, the resulting system would likely look dramatically different than the one in place today.

But assuming any shift from rewards goals to coordination goals will be gradual—and, after all, the two objectives are not mutually exclusive—it is likely more productive to consider how recognition of a coordination function would call for changes to patent policy at the margin. The next four sections highlight various characteristics and polices of the existing system that would need to be reevaluated as the coordination function takes on more prominence in comparison to the rewards function.

A. Reliability of Issued Patents over Correction of Patent Office Mistakes

A longstanding feature of the patent system is its two-stage review process, wherein an application is first examined by the patent office and then scrutinized a second time by a court when a patentee seek to enforce it.[140] The interaction of these two review periods implicates a variety of patent policy questions: the level of scrutiny to be applied at each stage, the deference (if any) to be applied from one stage to the other, the desirability of encouraging post-grant challenges, and so on. On one end of the spectrum, one could have a registration system, in which patents are issued by the patent office without any substantive examination, only to be reviewed *de novo* by courts should they come to litigation.[141] On the other end, one could have a system of ironclad patent grants, wherein applications are given extensive substantive review by the patent office, after which questions of patentability could be revisited only in cases of outright fraud.

Importantly, the allocation of responsibilities between the first- and second-stage decisionmakers is independent of the total amount of scrutiny applied throughout the process. Either the registration system or the ironclad grant system described in the prior paragraph could be implemented with many or few precautions against erroneous patent enforcement—the difference between the two models is only *when* those precautions would be applied. Ideally, the total investment in such precautions will depend on the likelihood and costs of errors in both directions (false positives and false negatives), as well as the expected benefits of any additional investment.[142] By contrast, the allocation of responsibilities between first- and second-stage decisionmakers should turn on the

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[140] In recent years, this two-period system has been complicated by the creation of multiple post-grant review processes, whereby the patent office itself may engage in further scrutiny after the patent has issued. *See* Gregory Dolin, *Dubious Patent Reform,* 56 B.C. L. REV. (forthcoming 2015). These processes are difficult to classify, because in some ways they are a form of extended first-stage examination, and in other ways they are an alternate forum for second-stage examination.

[141] *See* Scott Kieff, *The Case for Registering Patents and the Law and Economics of Present Patent-Obtaining Rules*, 45 B.C. L. REV. 55, 70-72 (2003) [hereinafter Kieff, *Registering Patents*].

[142] *See* Sawicki, *supra* note 127, at ___.

frequency with which issued patents turn out to be technologically or competitively significant, the comparative cost-efficiency and competencies of the first- and second-stage decisionmakers, and the consequences of an error being made at one stage of the process versus the other.[143]

A shift from the reward function to the coordination function has potential significance for both the total amount of scrutiny to be applied and the allocation of that scrutiny between first- and second-stage decisionmakers. When it comes to the total amount of scrutiny, the consequences of this shift from rewards to coordination are somewhat ambiguous. As discussed above, the rewards function implies a need to ensure that patents are awarded to those who deserve them and denied to those who do not. When a patent is erroneously granted, erroneously denied, or given to the wrong party, it weakens the correlation between the desired conduct and the promised reward.[144] The coordination function doesn't have this same reliance on initial allocation, but it does require that patents end up in the hands of those who are positioned to use them to exchange information. When a patent is denied to a firm that could have used it, the firm will need to go into the secondary market to acquire a patent in order to obtain the coordination benefits of the patent system. If the costs of doing this are substantial, the firm may forego the patent system altogether, instead relying on traditional methods of protecting its confidential information. In this way, the success of both the rewards and coordination functions could potentially turn on the accurate initial allocation of patents.

As a result, it isn't clear there is a generalizable answer as to which function would call for greater total investment in patent scrutiny. When the cost of trading patents is high,[145] there may be greater marginal returns to increased investment in patent allocation under the coordination function, since bargaining may be practically unavailable to fix mistakes. When the cost of trading patents is low, the balancing may come out the other way. Whether one function or the other calls for greater investment in the scrupulous allocation of patents may very well depend on facts and circumstances.

However, when it comes to dividing that scrutiny between the steps of initial examination and subsequent review, the policy implications of a move from rewards to coordination are clearer. As discussed above, the effectiveness of the coordination function depends significantly on the timing and degree of patent certainty.[146] If patents are frequently narrowed or invalidated after issuance, this leaves firms holding more of the risks of information sharing. Earlier certainty

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[143] *See* Lemley, *Rational Ignorance*, *supra* note 7, at 1511-23; Kieff, *Registering Patents*, *supra* note 141, at 74-76; Sawicki, *supra* note 127, at 778-80; Mark A. Lemley and Carl Shapiro, *Probabilistic Patents*, 19 J. ECON. PERSP. 75, 84-86 (2005).

[144] *See supra* notes 126–127 and accompanying text.

[145] And there is reason to believe this is often the case. *See* Merges & Nelson, *supra* note 50, at 874-75.

[146] *Cf.* Heald, *Transaction Costs*, *supra* note 3, at 508.

about the validity and scope of patent rights would thus make the system a more reliable tool for mitigating the potential downsides of disclosure.

Another (perhaps more subtle) way in which the coordination function depends on the stability of patent rights relates to costs of trading patents. As described above, the coordination function does not depend directly on the initial allocation of patent rights—Coasian bargaining is at least theoretically available as an alternate means of correcting mistaken patent grants. To the extent that the indeterminacy and instability of patent rights renders them more expensive to trade, overreliance on second-stage revocation may quixotically increase the systemic cost of erroneous grants, and actually increase the need to apply even more scrutiny at the first stage. Or, to put it positively, shifting scrutiny to an earlier point in the patenting process may enable bargaining as an alternate solution to erroneous allocations, and thus reduce the degree of scrutiny required overall.

By contrast, under the rewards function, the private incentives created by the patent system depend little on when patent awards become finalized. Rather, what matters is the net expected value of participating in the patent system. So if applicants are asked to bear a 10% risk that their truly patentable inventions will be erroneously denied the prize of a patent, it should make little difference how that risk is allocated between the various stages of the patent application and enforcement process.[147] Because the stability of grants is of no particular consequence for the rewards function, a purely rewards-focused view suggests it may be justifiable to regularly issue patents with serious doubts about their validity and encourage private litigation to fix errors after the fact.[148]

A move towards the coordination function complicates this grant-first, verify-later strategy. Moreover, the increased need for stability potentially implicates a wide range of patent policies, as the trade-off between first- and second-stage review is practically everywhere in patent law. For example, a move to coordination goals could warrant a reevaluation of the degree of patent office

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[147] *See* Abramowicz, *Patent Prizes*, *supra* note 38, at 215-18 (observing that harms from uncertainty to a prize system are easily overstated); Doug Lichtman & Mark A. Lemley, *Rethinking Patent Law's Presumption of Validity*, 60 STAN. L. REV. 57-59 (2007) (noting various sources of uncertainty confronting patentees). In practice, there may be slight differences in the expected value of participating in the patent system that turn on the timing of when this risk resolves—for example, depending on when applicants incur enforcement costs, the settlement value of their claims at different stages, and so on. But there is no clear rule of thumb that earlier or later certainty is necessarily better for patentees under a rewards system.

[148] *See* Lemley, *Rational Ignorance*, *supra* note 7, at 1517-18. And indeed a number of rewards-focused cases invoke the compelling public interest in seeing validity challenges litigated to completion. *See*, *e.g.*, F.T.C. v. Actavis, 133 S.Ct. 2223, 2230-34 (2013); Caraco Pharm. Labs., Ltd v. Novo Nordisk A/S, 132 S.Ct. 1670, 1677 (2012); Asahi Glass Co., Ltd. v. Pentech Pharm., *Inc*., 289 F. Supp. 2d 986, 994 (N.D. Ill. 2003); Blonder-Tongue Laboratories, Inc. v. University of Illinois Foundation, 402 U.S. 313, 345 (1971); Lear v. Adkins, 395 U.S. 653, 670-71 (1969).

scrutiny applied to applications prior to issuance,[149] the strength of the presumption of validity after a patent has issued,[150] the need for bounties or other incentives to challenge patents,[151] the enforceability of agreements not to bring challenges,[152] and the antitrust analysis applied to reverse settlement payments,[153] just to name a few.

Although each of these domains will require its own analysis, a recent dispute involving the presumption of validity illustrates how policy might come out differently under rewards- or coordination-focused points of view. When the patent office has considered prior art and specifically granted a patent in view of that art, the case for applying a strong presumption of validity in subsequent litigation is straightforward. After all, *both* the rewards and the coordination theories would advise a court to be cautious about second-guessing the judgment of the expert agency.[154] But what if—as in the case of *Microsoft v. i4i*[155]—new art is discovered that the patent office did not have the opportunity to consider? With principles of agency deference out of the way, and in view of the very real possibility that the patent office might have reached a different outcome if it had all the relevant facts, the Court was forced to confront the question of whether it is more important for patent grants to be settled or right.[156] As discussed above, the rewards function places a high value on allocating patents to the parties that deserve them, with comparatively less significance placed on the stability of patent

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[149] *See generally* Lemley, *Rational Ignorance*, *supra* note 7; Mark A. Lemley, Doug Lichtman & Bhavan Sampat, *What to Do About Bad Patents?*, 28 REGULATION 10, 12-13 (Winter 2005-2006).

[150] *See generally* David L. Schwartz & Christopher B. Seaman, *Standards of Proof in Civil Litigation: An Experiment from Patent Law*, 26 HARV. J.L. & TECH. 429 (2013); Lichtman & Lemley, *supra* note 147, at 45.

[151] *See generally* Joseph Scott Miller, *Building a Better Bounty: Litigation-Stage Rewards for Defeating Patents*, 19 BERKELEY TECH. L.J. 667 (2004); John R. Thomas, *Collusion and Collective Action in the Patent System: A Proposal for Patent Bounties*, 2001 U. ILL. L. REV. 305 (2001).

[152] *See generally* Rochelle Cooper Dreyfus, *Dethroning Lear: Licensee Estoppel and the Incentive to Innovate*, 72 VA. L. REV. 677 (1986); Rochelle C. Dreyfuss & Lawrence S. Pope, *Dethroning Lear? Incentives to Innovate After MedImmune*, 24 BERKELEY TECH. L.J. 971 (2009).

[153] *See generally* David W. Opderbeck, *Rational Antitrust Policy and Reverse Payment Settlements in Hatch-Waxman Patent Litigation*, 98 GEO. L.J. 1303 (2010); James F. Ponsoldt & W. Hennen Ehrenclou, *The Antitrust Legality of Pharmaceutical Patent Litigation Settlements*, 2006 U. ILL. J.L. TECH. & POL'Y. 37 (2006); Michael A. Carrier, *Unsettling Drug Patent Settlements: A Framework for Presumptive Illegality,* 108 MICH. L. REV. 37 (2009).

[154] *See* Intervet Am., Inc. v. Kee-Vet Labs., Inc., 887 F. 2d 1050, 1054 (Fed. Cir. 1989) (The presumption of validity . . . carries with it a presumption the examiner did his duty and knew what claims he was allowing.") Nonetheless, some question whether the patent office's initial scrutiny is extensive enough to warrant deference. Lichtman & Lemley, *supra* note 147, at 53-56.

[155] 131 S. Ct. 2238 (2011).

[156] *See id.* at 2251-52.

rights over time. This in turn suggests the presumption of validity should carry less force when a challenger brings forth prior art that the patent office did not consider—a result both the Supreme Court and rewards-focused commentators have endorsed.[157]

Under the coordination view, the importance of patent reliability is significantly heightened. The fact that the patent office might have reached a different outcome if it had more complete information does not undermine the core justification for the strong presumption of validity, which under the coordination view is to facilitate patent-backed information exchange by protecting the reliance interests of patent holders. Thus, absent fraud or other misbehavior by the patentee,[158] and contrary to the result obtained under a rewards-focused analysis, coordination-focused patent policy would suggest that the strength of the presumption of validity should not turn on the nature of the evidence that happens to be brought against the patent.

This is but one example of how a move towards the coordination function would call existing patent doctrine into question; the various policy questions highlighted above will undoubtedly require more extensive analysis. As a general rule, however, coordination-focused patent policy will tend to prefer rules favoring earlier certainty, at least as compared to the traditional rewards-based approach.

B. Technological Exclusivity over Market Exclusivity

Another persistent issue at the heart of patent policy is the breadth of protection that ought to be afforded to a successful patentee. Under rewards-focused policymaking, this balancing comes down to questions about exactly how large a prize is necessary to incentivize invention, and whether larger prizes are expected to justify their larger costs. In general, the broader the claim scope, the larger the reward promised by the patent system, and the larger the costs imposed on the rest of society.[159] In the other direction, the narrower the claim scope, the

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[157] Although the presumption of validity still applies in cases of new evidence, the patent office's judgment loses "significant force," and the existence of evidence not considered by the agency is typically noted for the jury. *Id*. at 2251. Recent empirical work has suggested that, in practice, flagging the existence of new evidence like this may have the same effect as if no heightened presumption were applied at all. *See* Schwartz & Seaman, *supra* note 150, at 432, 459. Doug Lichtman and Mark Lemley tie this concern to rewards goals concisely, concluding that the presumption "seems to encourage investment in the wrong inventions . . . technologies that are likely redundant to things society knew before." *See* Lichtman & Lemley, *supra* note 147, at 58.

[158] Even under a coordination-focused approach, it may be useful to weaken the presumption in some circumstances as a form of disciplining the conduct of applicants during the examination process—as in the case when the applicant knew of a prior art reference but did not disclose it. The distinction here is between regulating the conduct of applicants—which they can typically control—and protecting them from developments—like the discovery of previously unknown prior art—that are typically outside their control.

[159] *See* Yelderman, *supra* note 131, at 88-89.

lower the costs to everyone else—but smaller too are the incentives created by the patent system.[160]

Setting claim scope to produce a right-sized reward is very tricky business. For the rewards function to be effective, the patent system must award valuable patents to valuable inventions.[161] This means claim scope must be broad enough to create market power, at least when the underlying invention turns out to be important.[162] But market power is also a driver of the major costs of the patent system—the static and dynamic losses from the patentee's exclusive use of the invention.[163] What makes this trade-off more difficult than, say, selecting the size of the purse in a cash prize system, is that there will not always be a predictable relationship between the scope of technical exclusivity (the breadth as defined by the patent's claims) and the scope of market exclusivity (which will determine the patent holder's market power and hence the value of the patent prize).[164] The patent office examines claims for their technical novelty, but patent value often depends on whether there turn out to be competing, marketable solutions. For example, a technically broad patent could turn out to have little competitive significance if a handful of alternative solutions using fundamentally different technologies emerge soon thereafter. And a technically narrow patent could inadvertently dominate an entire product market if it happens to cover a critical step in a larger process. This can lead to significant divergence in individual cases between a patentee's technical accomplishment and the value of the prize awarded.[165]

These questions about the right-sizing of exclusive rights are not limited to the initial granting of claims by the patent office. They also emerge when patentees attempt to enforce their rights in technology areas far from the original invention,

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[160] *Id*.
[161] *See* Liivak, *Maturing Patent Theory*, *supra* note 10, at 1165.
[162] *See* Crouch, *supra* note 132, at 142-43; Scotchmer, *supra* note 36, at 103-05; Lemley & McKenna, *supra* note 132, at ___; Arial Katz, *Making Sense of Nonsense: Intellectual Property, Antitrust, and Market Power*, 49 ARIZ. L. REV. 837, 858-59 & n.117, 862-63 (2007).
[163] *See* Liivak, *Maturing Patent Theory*, *supra* note 10, at 1172-73. In IP theory generally, this balancing is often referred to as the "incentives vs. access" tradeoff. *See* Glynn S. Lunney, *Reexamining Copyright's Incentives-Access Paradigm*, 49 VAND. L. REV. 483, 556-570 (1996).
[164] *See* Michael A. Carrier, *Unraveling the Patent-Antitrust Paradox*, 150 U. PA. L. REV. 761, 791-92 (2005). For a thorough discussion of the relationship between technical exclusivity and market exclusivity, *see* Jeanne C. Fromer & Mark A. Lemley, *The Audience in Intellectual Property Infringement*, 112 MICH. L. REV. 1251, 1285-94 (2014).
[165] *See* Crouch, *supra* note 132, at 149-54; F.M. Scherer, *The Innovation Lottery: The Empirical Case for Copyright and Patents*, in EXPANDING THE BOUNDARIES OF INTELLECTUAL PROPERTY: INNOVATION POLICY FOR THE KNOWLEDGE SOCIETY 3-21 (Rochelle Cooper Dreyfuss et al. eds., 2001). Michael Abramowicz makes a similar observation (albeit from a different angle) in noting the difficulties of valuing patents for purposes of a government-funded buyout. *See* Abramowicz, *Patent Prizes*, *supra* note 38, at 155-56.

expand the scope of their exclusivity through acquisitions of competitors' portfolios, and request broader claims late in the patent lifecycle.[166] From the perspective of the rewards theory, each raises a similar question about whether the expected benefits from increasing patent rewards through an expansion of claim scope are worth the expected cost, in light of available alternatives to achieve the same result. In practice this is quite difficult, particularly because it is so challenging to map technical exclusivity onto market exclusivity in a predictable way.[167]

The coordination function implies a very different set of concerns when it comes to claim scope. As described above, the coordination function depends on the ability of a firm to exclude others from making use of the information that will be the subject of disclosure. If the scope of protection afforded by its patent portfolio is too narrow, it may be incapable of backstopping contractual agreements around technical information or enabling wider information sharing.[168] But this does not mean the coordination function calls for patents of unlimited scope. Once a firm's portfolio is broad enough to prevent others from using the firm's particular technology, the coordination benefits to providing any broader scope of exclusion diminish substantially.[169] Thus the coordination function would call for claim scope that provides just enough technical exclusivity to facilitate sharing of information about a firm's specific technology, but without reaching to competing solutions.

This highlights an important distinction between the coordination and rewards theories: the benefits of the coordination function flow from technical exclusivity, not market exclusivity. Provided a patent (or portfolio of patents) is broad enough to prevent others from using the shared information, the degree to which competition is displaced at the level of the relevant product market is irrelevant to the operation of the coordination function.[170]

A simple example illustrates how the appropriateness of claim scope would be assessed differently under either a rewards- or coordination-focused

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[166] *See*, *e.g.*, Kaplow, *supra* note 1, at 1867-73; *see also* Posner, ANTITRUST LAW 91-92; Bowman, *supra* note 1, at 200-203.

[167] For a similar point regarding the failure of patent scope to account for market structure, *see* Scotchmer, *supra* note 36, at 117-18.

[168] *Cf.* Burstein, *supra* note 6, at 259-60.

[169] It is possible that broader scope could facilitate disclosure and exchange of certain non-technical information: customer lists, marketing techniques, and so on. However, these are outside the scope of the coordination function, since they do not relate to the transfer of technical information. *See supra* II.A. The costs and benefits of using exclusive rights to enable disclosure of non-technical information are likely quite different, and would require their own analysis.

[170] The degree of market exclusivity still matters because it will have a significant effect on the public costs of offering patent protection. The insight here is only that the *benefits* of the coordination function turn on technical exclusivity, not market exclusivity, and that this metric can be more directly influenced by policymakers.

patent system. Suppose there is a pressing and widespread problem that everyone would like to see solved. Companies A, B, and C set down different technological paths, each in pursuit of its own distinct solution. And it turns out that all three are successful: Company A files for a foundational patent on its approach, as do Companies B and C on their respective approaches. All three companies continue to work diligently to commercialize their technologies, investing in further research and preparing to ramp up production.

In a perfect world, how broad should each company's exclusive rights be in this situation? From a rewards perspective, the answer is not entirely clear. Should the patent office grant Company A claims that cover the entire product market, or just its particular solution? Should antitrust authorities allow Company A to buy Company B's patent portfolio? Should a court enforce a three-way license agreement between the competitors that sets a minimum price on any infringing products that any of the three companies sell? These questions are more difficult to answer than they might first appear. If unrestrained competition is allowed to break out among the three companies, there is a risk that prices will quickly fall to marginal cost and none of them will be able to recoup their investment in research and development. But if competition is eliminated entirely, the rewards granted by the patent system could be inappropriately large, resulting in unnecessary deadweight losses and other social harms. Though in individual cases the analysis may not be so nuanced, the rewards theory constantly confronts the same recurring question: whether an n-competitor product market offers sufficient incentives to invent, or whether some additional reduction in competition should be granted or available.[171]

From a coordination perspective, the answer is straightforward: each company should be granted patent protection broad enough to enable sharing of information related to its specific technology. Exclusivity that assures each firm that others will not be able to use its particular solution to the problem should be sufficient to reduce the cost of further development and increase the firm's technical transparency. Critically, the effectiveness of the coordination function does not turn on the extent of the market power created by patents. In fact, the goals of coordination can be perfectly satisfied even if Companies A, B, and C end up in brutal three-way competition in the relevant product market. And, though the question of how broad patent protection must be to facilitate sharing of information and transfer of technology may at times be a challenging one to answer, it is also a question the patent office is institutionally better equipped to navigate, as it depends on the state of technology rather than the state of competition.

[171] If this framing seems foreign to those familiar with the manner in which the patent office examines claims to determine their appropriate scope, it should. This only highlights the disconnect between the intermediate goal of the rewards function (market exclusivity) and its means (technical exclusivity).

This observation is an important one, not least because it suggests that much of the debate about the desirability of the coordination function has been based on flawed assumptions. Since its inception, the coordination function has been associated with a policy prescription of issuing broad patent claims early in a technology's lifecycle.[172] Operating on this premise, commentators have divided as to whether this feature of the coordination function is a blessing or a curse.[173] But upon reexamination, the coordination function's reliance on technical exclusivity rather than market exclusivity may mean it can be implemented with *narrower* patent grants than can the rewards function. As a general rule, it should be possible to create technical exclusivity with scope equal to or less than the scope necessary to create market exclusivity. Assuming the patent office can implement this strategy consistently, there may actually be less need for broad claims in a patent system focused on coordination than in one focused on rewards.

Another consequence of this distinction is that coordination theory may offer some help with problems that have transfixed traditional rewards theory, such as the antitrust analysis that should be applied to a merger of competing patent portfolios. The present conundrum of the rewards function is that it asks the antitrust regulator to trade static harms (increased market power) against potential dynamic benefits (increased incentive to invent). This balancing is tough enough at a macro level, but it is even more difficult to perform through a series of individual enforcement decisions. As a result, current patent and antitrust rules can provide few concrete answers as to when patent portfolio aggregation is pro-competitive and when it is harmful.[174]

An (even partial) adoption of coordination goals could lead to a simpler principle for determining when patent portfolio aggregation is justified and when it is not. As discussed above, the coordination function depends on a firm holding a patent portfolio that enables it to reliably exclude others from a particular technological solution. Sometimes such protection will be granted in the form of a single patent, or multiple patents issued to the same firm. In other cases, the initial patent grants will fracture the rights in a way that makes them too narrow to facilitate coordination. In this situation, coordination-focused patent policy would recognize an efficiency justification *in favor* of combining multiple patent portfolios. But, importantly, the coordination function's focus on technical exclusivity over market exclusivity would also impose a limit. When two competing portfolios relate to different technologies, there is no added

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[172] *See* Kitch, *Nature and Function*, *supra* note 3, at 267-68. Indeed, this association is so strong that it is often unclear whether "prospect theory" refers to the goal of coordinating development or this particular collection of patent policies. See *supra* n. 58.

[173] *See* Duffy, *supra* note 58, at 442-46, 499-500; McFetridge & Smith, *Patents, supra* note 58, at 198; Landes & Posner, *supra* note 3, at 319; Abramowicz, *Underdeveloped Prospects*, *supra* note 33, at 1081; Scotchmer, *supra* note 36, at 112-14.

[174] *See* Keke Feng, *Patent-Related Mergers and Market Definition Under the 2010 Horizontal Merger Guidelines: The Need to Consider Technology and Innovation Markets*, 34 T. JEFFERSON L. REV. 197, 201 (2011); Scotchmer, *supra* note 36, at 161, 177-78.

coordination benefit to be found in their aggregation, and further combinations may only serve to reduce competition. Thus the coordination view could provide a framework for distinguishing between desirable and undesirable combinations of patent portfolios, a line that existing, rewards-based doctrine often struggles to draw.

C. A Window of Patent Maturity over Precise Timing of Grants and Expiration

Another persistent set of issues in the theory and implementation of the patent system relates to time. At what point in the development of a technology should patent rights be granted? For how long should they last? What is the significance of the period between when an inventor is eligible to apply for a patent and when that patent legally comes into force?

When cash prizes are used to reward invention, the timing of those prizes is critical. If the purse for accomplishing some result is given too early, the system may create inappropriately large incentives to race towards that premature finish line, followed by inappropriately small incentives to actually complete the project.[175] On the other hand, if the purse is awarded too late in the process, the incentives to achieve the desired result are weakened, at least because of the risk that a firm may be the first to accomplish the big breakthrough, only to be snaked by a second-mover that steps in to claim the prize.[176] Thus, it is not only important that the reward be the right size and given to the right person, but that all of this happens at an appropriate point in the technology development cycle.

Providing incentives to invent through a system of patent grants solves some, but not all, of these problems. One of the benefits of using exclusive rights (such as patents) in lieu of cash prizes is that they can create incentives both before *and* after the moment of grant.[177] So if patents are granted before the desired invention is truly completed, it's not the end of the world, because the owner of that patent will still have some incentive to continue development of the project—doing so improves the value of her patent. This takes some of the pressure off the matter of when an invention should become patent-eligible, though there are nonetheless complex issues at play in correctly balancing pre- and post-grant incentives and in ensuring that patents expire at an appropriate time.[178]

A move towards coordination goals further relaxes the requirement that inventions become eligible for patents at a precise point in a technology's development. The coordination function is not intended to directly incentivize any specific conduct, so it does not imply a need to align the timing of a prize with the

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[175] *See* Abramowicz, *Patent Prizes*, *supra* note 38, at 176-77.
[176] *See* Abramowicz, *Patent Prizes*, *supra* note 38, at 187-88 (discussing possibility of gamesmanship around timing of patent grants).
[177] *See* Kitch, *Nature and Function*, *supra* note 3, at 276-77.
[178] *See* Duffy, *supra* note 58, at 476-80; Abramowicz, *Underdeveloped Prospects*, *supra* note 33, at 1080-81; Sichelman, *supra* note 30, at 393-94; Kieff, *Property Rights, supra* note 33, at 710-12.

arc of any particular private accomplishment. Just as the coordination function does not depend directly on *who* is awarded patents, it does not necessarily depend on the precise timing of *when* they get patents.

However, there is another set of timing concerns that does matter for the coordination function. The first relates to the fact of technological change. As described above, the effectiveness of the coordination function turns on the expectation of firms that they will be to reliably control the use of information after sharing. The ability of patents to do this depends on there being a subject matter relationship between the patents in a firm's portfolio and the information to be transferred in reliance on that portfolio. This subject matter relationship can change over time. As technology progresses, portfolio that might have once facilitated a lot of information exchange may cease to be useful for coordination. For example, a thick collection of patents related to VHS tapes may have had a lot of coordination value to consumer electronics manufacturers in the '80s and '90s, but such a portfolio likely lost much of this value as technology moved to Blu-Rays and DVDs. If technology moves on but a firm's portfolio stays the same, the likelihood of successful patent-based exclusion and the value of that exclusion will gradually fall. As the relationship between the firm's present activities and its patent portfolio weakens, patent-based exclusion ceases to be a realistic fallback, and the effectiveness of the coordination function is reduced.

Another concern arises from the fact that patent grants are statutorily limited in time. In some situations, this legal expiration date may make patent remedies a very weak substitute for secrecy. For example, if a patent is set to expire in six months, it may do little to backstop the transfer of information that could have been profitably kept secret for a longer time period. This does not mean patents late in their term are useless for coordination—only that the types of information transfer a patent can facilitate will diminish over its lifetime. For example, even a single year of patent protection may be enough to enable the exchange of information with only short-term value, or with value that could not have been very effectively maintained for very long under secrecy anyhow. The ability of a patent to backstop information exchange thus turns on both the length of the patent's remaining term and the prospects for the information's value under secrecy.[179] Holding all else equal, this balancing will move towards secrecy and away from patent-backed information sharing as patents age.

A third concern cuts the over way. While the threats of legal expiration and technical obsolescence tend to reduce the usefulness of patents over time, the need for reliability tends to favor older patents. While there may be situations where early-stage applications or young patents have a high degree of reliability,[180]

[179] This implies there may be some information that can't be backstopped by even very young patents—that is, information with significant long-term value that can be protected by secrecy for much, much longer than the patent term.

[180] For example, some breakthroughs may be so substantial and likely to be publicized that an inventor can be confident that she is in fact the first to arrive at a particular solution,

the typical patent application starts with a large amount of uncertainty that gradually resolves over time. In the early stages, there is often doubt as to whether a patent will issue, whether it will hold up in court, what exactly it will be able to exclude, and so on. As time goes on, more information is revealed: the patent office acts on the application, competitors introduce prior art (or don't), validity challenges are brought (or aren't), a court affirms the patent's exclusive force (or doesn't). Each round of review updates the probability that a patent will be able to backstop future information transfers.

Though developments for individual patents can go in either direction, a winnowing effect causes the reliability of the patents that matter to slowly rise over time. Early on, a good number of patents fail—they're rejected, invalidated, or their scope is narrowed substantially—and hence become irrelevant for purposes of coordination. Others survive—they issue, their validity is affirmed, their scope is interpreted to be sufficiently broad. And these survivors begin to provide a predictable sphere of reliable exclusion around which a firm can plan what it can disclose and what it must take traditional precautions to protect. The ability of a portfolio to backstop exchanges of information will thus typically rise as its constituent patents age and mature.

These competing considerations inform when a patent will be at its peak effectiveness for facilitating coordination. Often, if a patent is too young, it will not be reliable enough to backstop informational exchange. But, on the other hand, if it a patent is too *old*, it will also not be useful for backstopping exchange, either because of its limited remaining term or the looming threat of technical obsolescence. As a result, the coordination value of any given patent likely peaks somewhere in the middle of its lifespan: after the patent has issued (and perhaps survived some degree of post-grant review), but before further technological development makes it irrelevant to ongoing industry activities. It is these patents in the middle—adequately mature, but not yet obsolete—that are best positioned to serve the coordination function.[181]

Comparing these timing concerns to those of the rewards function suggests that this is another area where the long-assumed policy implications of coordination are due for reexamination. The conventional wisdom is that the coordination function requires granting patent rights at very early stages of

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even before the formal steps of patent office review and district court litigation have occurred.

[181] Without a stable stock of patents meeting these criteria, the coordination function may run in fits and starts. For example, there may be some period of time when a firm's portfolio of VHS patents is obsolete and its portfolio of DVD patents is not yet mature. If that were the case, the ability of patents to facilitate information exchange would be expected to wane during the interim. Moreover, in some industries, technology may move so much faster than the patent system that the opportunity for patent-backed information exchange is virtually non-existent. *See* Mann, *supra* note 74, at 978-79.

technical development.[182] But it isn't actually clear whether the coordination function requires granting patents any earlier in time than the rewards function does. As explained above, the question of when to grant patents for purposes of rewards is a thorny one. And, in practice, the current rewards-focused system allows for patent eligibility quite early in the development process, typically well before inventions have been commercialized or reduced to practical form.[183]

As compared to the rewards function, the coordination function is much more sensitive to the window of patent maturity—the time between when a patent becomes reliable and when it expires or becomes technologically irrelevant. Of course, this implies some dependence on the timing of grants, because a patent cannot be reliable if there's no legal right to claim it yet. But this is a necessary not sufficient condition, and the timing of patent grants and the timing of patent maturity are in many ways independent. One could, hypothetically, design a patent system that puts the finish line for patentability fairly late in the development process—for example, only after a commercially viable prototype is physically presented to patent examiners—but that then moves to escalate the reliability of those rights with lightning speed—an intense one month examination window, say, followed by an irrebuttable presumption of validity. Even though such a system would set patent eligibility at a comparatively late point in time, it would allow patents to become reliable at a comparatively early point in time, thus allowing the system to serve a coordination function despite the late patent grants.

Viewed from the perspective of the coordination function, the current timing of patent rights leaves much to be desired. Inventions become eligible for patenting early in the development process, but it is typically years before any patents actually issue,[184] and years still before those patents become reliable through testing in litigation or post-grant review.[185] These steps not only delay when patents will be available for coordination, but also shorten the expected window during which they will be useful, as technical obsolesce always looms on the horizon.[186]

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[182] As with the question of claim breadth, this assumed policy implication goes back to some of the earliest discussions of the coordination function. *See* Kitch, *Nature and Function*, *supra* note 3, at 267-68.

[183] *See* Christopher A. Cotropia, *The Folly of Early Filing in Patent Law*, 61 HASTINGS L.J. 65, 72-82 (2009); Sichelman, *Commercializing Patents*, *supra* note 30 at 355-66.

[184] *See* U.S. PATENT & TRADEMARK OFFICE, PERFORMANCE AND ACCOUNTABILITY REPORT FOR FISCAL YEAR 2011, at 14 (2011), available at http://www.uspto.gov/about/stratplan/ar/USPTOFY2011PAR.pdf (average time to first action after a patent application is between twenty-five and twenty-eight months and average total pendency is between thirty-one and thirty-six months).

[185] *See* Dolin, *supra* n. 140

[186] *Cf.* Feldman & Lemley, *Does Patent Licensing Mean Innovation*, *supra* note 6 (observing that rapid technical obsolescence combined with patent office delays may prevent patents from facilitating technology transfer).

Thus, contrary to prior assumption, a move towards coordination would not require moving the moment of patent eligibility any earlier in time (or even justify the current early threshold). Rather, coordination-focused policy would emphasize reforms that would allow patent rights to mature and stabilize more quickly, without regard for where exactly the threshold of patent eligibility is set. Instead of dictating changes for the substantive standards of patentability that control the timing of grants and expiration,[187] the coordination function implicates the *process* of patenting: the number of patent examiners, the speed and efficiency of the patent office, the window for post-grant review, level of the deference paid to these early rounds of administrative decision making. Perhaps surprisingly, the timing concerns of the coordination function may have more to do with the backlog of applications pending at the patent office than the doctrines of patent eligibility with which it is typically associated.[188]

D. Core Rights over Bundle of Value

Another important difference between the operation of the rewards function and the operation of the coordination function is the manner in which different policies interact to influence the system's effectiveness overall. As the rewards function depends on transferring a prize of appropriate private value to inventor, courts and commentators typically evaluate the patent system from a "total bundle of value" perspective, which considers the costs and benefits of participating in the patent system from start to finish. By contrast, the effectiveness of the coordination function relies critically on patent holders having a certain core set of rights at a particular juncture in time, and is not as dependent on other aspects of the patent system. This difference suggests that courts and commentators would need to approach their tasks differently if coordination goals were to gradually displace rewards goals.

As described above, the conventional approach to rewards-focused policymaking calls for careful stewardship of the entire value proposition the patent system presents to prospective inventors.[189] The lure of patenting depends on just about everything: the cost of filing an application, patent term, damages calculations, the availability of exhaustion defenses, and so on. Further complicating matters, in a perfect world, a policymaker would coordinate all of these tools to provide an appropriate reward to inventors at the lowest possible cost to society.[190] *How* invention is rewarded doesn't matter for purposes of the underlying theory, so a policymaker has a great deal of flexibility in assembling the package of rights and duties that will do so at lowest cost.

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[187] The rules for enablement, written description, and patentable subject matter are the most prominent examples. *See* Sichelman, *supra* note 30, at 355.

[188] As discussed above, the coordination function (and its prospect theory parent) have long been associated with "broad, early patent grants," not "swift, effective examination." *See supra* nn. 14 & 58.

[189] *See supra* notes 47–49 and accompanying text.

[190] *See* Gilbert & Shapiro, *supra* note 46, at 106.

These rewards-focused trade-offs are not limited to questions of patent law. Under the rewards view, almost anytime there is a question involving the intersection of patent law and other fields of law—contracts and antitrust being the most prominent examples—there is an opportunity to infuse the prevailing doctrine of the other domain with additional, patent-specific considerations.[191] Indeed, almost any legal question that arises in the lifecycle of a patent is a potentially valuable lever for refining the patentee's bundle.[192] The operative mode of rewards-focused policymaking is one of expansive fungibility.

In the case of the coordination function, however, such far-reaching substitutability cannot be assumed. The core features of strong and reliable patent-based exclusion cannot be traded against other features of patent policy. Rather than balancing the value proposition of the total bundle of patent rights against deadweight losses, patent policymakers would need to focus on ensuring that the bundle contains the core rights necessary to enable information transfer. From the perspective of the coordination function, many patent policy levers are distinctly secondary.[193] If patent-based exclusion is inadequate or unreliable, patents may do little to mitigate these risks, and scarce patent-backed information sharing may occur as a result.

In some ways this shift is constraining; in other ways it is liberating. The constraint is that the coordination function leaves a policymaker with far less latitude to compromise the core patent rights and make up the difference somewhere else. On the other hand, the emphasis on core rights creates freedom of movement on many other questions. For example, patent application fees and examination standards can be adjusted based on practical, administrative concerns, without the rewards-focused concern that such changes will undermine the system's value. Moreover, it becomes possible to restore the integrity of adjacent areas of law (such as antitrust and contract) that have become infused with

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[191] *See*, *e.g.*, Walker Process Equip., Inc. v. Food Mach. & Chem. Corp., 382 U.S. 172, 179-80 (1965) (Harlan, J., concurring); Nobelpharma AB v. Implant Innovations, Inc., 141 F.3d 1059, 1071 (Fed. Cir. 1998) (imposing antitrust liability for "clearly reprehensible" conduct before the patent office); In re Indep. Serv. Organizations Antitrust Litig., 203 F.3d 1322, 1327-28 (Fed. Cir. 2000) (no antitrust liability for unconditional refusal to sell patented parts absent fraud on the patent office, sham litigation, or tying); Image Technical Servs., Inc. v. Eastman Kodak Co., 125 F.3d 1195, 1218 (9th Cir. 1997) (desire to prevent others from entering patented market is a "presumptively valid business justification" for otherwise exclusionary conduct); Lear, Inc. v. Adkins, 395 U.S. 653 (1969); Brulotte v. Thys Co., 379 U.S. 29 (1964).

[192] *See* Kaplow, *supra* note 1, at 1855-67; Daniel A. Crane, *Intellectual Liability*, 88 TEX. L. REV. 253, 271-74 (2009); Ordover, *supra* note 64, at 50.

[193] To be clear, this *doesn't* mean that the coordination function depends only on these three elements—one can imagine policies that would also make it impossible to use patents for coordination, even if these three elements are set correctly. For example, significant taxes or restrictions on the transfer of patents from one party to the other might prevent patents from being in the hands of those who are well-positioned to use them to backstop information transfers. *See infra* III.B.1.

overtones of patent policymaking. Under the coordination function, there is neither the same need nor opportunity to enlist non-core doctrines in service of patent law.

One could debate whether, on balance, this change is more constraining than it is liberating, or vice versa. But it is certainly quite simplifying. As others have, assembling a bundle of rights that will transfer an appropriate reward to inventors at the lowest possible cost to society is much easier said than done.[194] For example, it is more cost-efficient to reward invention by expanding antitrust immunities, or by requiring a higher burden of proof to invalidate an issued claim? Is it preferable to expand the scope of patent remedies, or lower application fees? Sometimes, perhaps, a rewards-focused policymaker will have the information she needs to appropriately balance these objectives. But sometimes (perhaps frequently[195]), the conventional rewards goal will point in indeterminate or conflicting directions, requiring consideration of secondary factors to break the ties created by uncertainty.

In this way, recognition of the potential coordination value of the patent system could be useful even if coordination goals *don't* displace rewards goals. The optimal policy for implementing the coordination function will sometimes be ambiguous as well, but lessons from the coordination function are often revealing in situations where the rewards function is ambivalent. For example, as between an additional antitrust immunity that will be extremely valuable to patentees on rare occasions and an equally valuable but modest increase in the likelihood a court will find a claim valid, the coordination function would break the tie in favor of the latter. Antitrust giveaways have (at most) an indirect effect on the coordination function, while improvements in the reliability of patents are almost always helpful. Along similar lines, a rewards-focused policymaker may be ambivalent as between increasing the cost of obtaining a patent or reducing the scope of patent remedies. Again, the coordination function provides a clear answer: as far as coordination is concerned, there is little harm to increasing the cost of acquiring a patent, but the force of patent remedies is directly determinative of the system's effectiveness. If the rewards function is indifferent, the policymaker is better off increasing acquisition costs rather than trimming the scope of patent-based exclusion.

In this way, the coordination function could have an important role to play in patent policy, even if coordination itself is only recognized as a secondary goal of the patent system. While each case will require its own analysis, as a general rule the coordination function would advise constructing patent rewards out of

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[194] *See* Kaplow, *supra* note 1, at 1842-45; Liivak, *Maturing Patent Theory*, *supra* note 10, at 1175; Gallini, *Patent Policy, supra* note 50, at 60; Klemperer, *supra* note 46, at 120-24; Gilbert & Shapiro, *supra* note 46, at 106; Oskar Liivak, *Establishing an Island of Patent Sanity*, 78 BROOK. L. REV. 1349-50 (2013) (collecting sources noting the uncertainty surrounding this question).

[195] *See* Liivak, *Patent Sanity*, *supra* note 194, at __.

rights that facilitate reliable, cost effective exclusion and low transactions costs, over complex, high-stakes regimes with lower predictability.

V. CONCLUSION

This Article has defined the coordination function, set out a theory of that function's operation, and shown how a number of characteristics of the patent system would likely be different if it were geared towards coordination instead of rewards. This analysis suggests that much of the prior discussion about the desirability of using the patent system to pursue these goals has been rooted in unfounded assumptions about what such a system would actually look like.

However, it is important to note what this Article has *not* done—made the case one or the other on behalf of the coordination function. This Article accepts the coordination justification for the sake of argument to explore its underlying theory and consequences for patent policy. It does not evaluate the costs and benefits of using patents in this way, and certainly does not suggest that the normative desirability of coordination goals is a foregone conclusion.

This Article is studiously neutral on these first-order matters for a simple reason: a deeper understanding of the policy implications of the coordination function is a critical prerequisite to evaluating the desirability of using patents for coordination. In some ways, the requirements of the coordination function described above may be a refreshing change from the concerns that have so far driven rewards-focused patent policy. In other ways, a coordination-focused approach to policymaking may only exaggerate present concerns with the rewards-focused system. In either event, it is clear that the differences between a rewards-focused and coordination-focused system are real, and these differences may be enough to seal the case for or against the coordination function.

There is also a need for future work comparing the expected costs and benefits of addressing coordination problems through both patent and non-patent mechanisms. In the absence of patent protection, parties seeking to forge agreements for or around technical information can be expected to rely on a combination of trade secrets, non-compete agreements, other contractual restraints, and informal or reputational arrangements. The comparative costs and benefits of these approaches vis-a-vis patents remain largely unexplored.

Moreover, it is unclear whether the case for the coordination function will be the same across all of the various technical fields that share our unified patent system. It is possible that contracts and trade secrets work well enough for some industries, while the need for patent-backed information exchange in other industries is acute. Just as the case for the rewards function varies from industry to industry,[196] the case for coordination may be strong in some fields and weak in

[196] *See generally* Burk & Lemley, *supra* n. 14.

others. It would be particularly valuable to understand how the rewards and coordination justifications interact on an industry-by-industry basis.

It is also possible that the right question to ask may be not whether or not it is desirable to use the patent system to facilitate coordination, but *how much* patent-based coordination is worth its cost. It is one thing to accept that the patent system is useful for facilitating some amount of coordination, yet another thing to determine the optimal level of patent-backed coordination. Future work will need to confront the inevitable question of when the costs of these exclusive rights begin to exceed their benefits.

Finally, the ultimate goal of this inquiry will likely be to re-integrate the rewards and coordination functions for a unified approach to patent policy. As many of the costs of using a system of proprietary rights to incentivize invention are shared with the costs of using the same system to coordinate private development, it is quite possible that the optimal level of rewards-focused patent protection and the optimal level of coordination-focused patent protection are interdependent. In other words, there may be significant synergies available by using the patent system for both purposes simultaneously, enabling a degree of protection that would not be justified by either benefit standing alone. And, conversely, new developments undermining one justification may cause the optimal level of both kinds of protection to fall, inasmuch as each depends on the other. There thus remains much to be explored regarding the interrelationship of these two functions.